"Journal of Gas Lighting, Water Supply, and Sanitary Improvement."— Feb. 29, 1916.—Registered as a Newspaper.

Chemical Lib.
MAR 18 1916
UNIV. OF MICH. LIBRARY

Journal of Gas Lighting and Water Supply

Vol. CXXXIII. No. 2755.] LONDON, FEBRUARY 29, 1916. [68th Year. Price 6d.

O'NEILL'S
OXIDE
GAS PURIFICATION & CHEMICAL CO., Ltd.
PALMERSTON HOUSE, LONDON, E.C.
Telegrams: "PURIFICATION, LONDON."
Telephone: 9144 London Wall.

TORBAY
STOVE BLACK
FOR GAS COOKERS.
The TORBAY PAINT CO.,
26, 27, & 28, Billiter St., London, E.C.
39-41, Old Hall St., Liverpool.

PUMPING ENGINES
All Types for ACID, &c.
CAST-IRON OR STEEL TANKS
Any Capacity.
CHEMICAL PLANT.
Roofs and Girders. Structural Work.
SULPHATE OF AMMONIA PLANT
Air and Gas Compressors.
MIXERS.
TAR STILLS AND CONDENSERS.
W. NEILL & SON, Ld.
Engineers, Iron & Brass Founders,
ST. HELENS JUNCTION.
Telegrams: 'Neill, St. Helens.' Telephone No. 20.

BROWNOX-DE-LUXE
and
BROWNOX
British Purifying Material
Of Proved Efficiency.
SPENT OXIDE PURCHASED
Exchange or Loan Terms Arranged.
J. BROWN & CO., Ltd.
Savile Town, DEWSBURY.

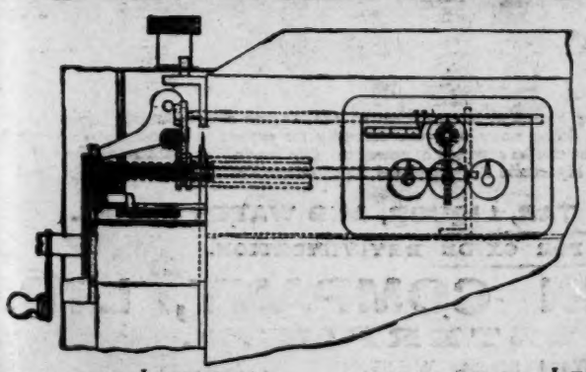
FLEXIBLE METALLIC TUBING CO. LTD.
FOR GAS, OILS, HIGHEST STEAM PRESSURE
112 QUEEN VICTORIA St E.C
PONDERS END MIDDLESEX

Makers of
GASHOLDERS,
TANKS (C.I. or Steel),
PURIFIERS,
WASHERS,
ROOFS,
&c.
ASHMORE, BENSON, PEASE & CO., LTD.
STOCKTON-ON-TEES.
Complete
GAS WORKS
London Office:
32, Victoria Street, Westminster, S.W.
Telegrams: "GASHOLDER."

JAMES McKELVIE & CO.
Coal Owners,
Cannel and Gas Coal Contractors,
17, RUTLAND SQUARE, EDINBURGH.
59, MARK LANE, LONDON, E.C.
Telegrams: "Mackelvie, Fen. London."
Telephone: Avenue 2177.
GUILDHALL CHAMBERS, SANDHILL, NEWCASTLE-ON-TYNE.
24, CHAPEL STREET, LIVERPOOL.
VICTORIA BUILDINGS, BUTE DOCKS, CARDIFF.
Prices and Analyses of all the Principal Cannel, Gas, and Steam Coals forwarded on application.
ESTABLISHED 1868.

W. & B. COWAN
Incorporated in Parkinson and W. & B. Cowan, Ltd.
LONDON. MANCHESTER. EDINBURGH. GLASGOW.
SYDNEY. MELBOURNE. BRISBANE. WELLINGTON, N.Z.
(See Advertisement on page. iii. of Wrapper.)

STEWARTS AND LLOYDS, LIMITED, 41, OSWALD STREET, GLASGOW. BROAD STREET CHAMBERS, BIRMINGHAM.
TUBES & FITTINGS for Gas, Steam, Water, &c.

GEORGE GLOVER & CO., LTD.,
CHELSEA.

"THE STANDARD"
SLOT METER.
THE ACME OF SIMPLICITY.
NO SPRING in any part of the mechanism.
Can be fitted with STRONG BOX, if desired, or with "M & M" LOCK.
LONDON:
RANELAGH WORKS,
ROYAL AVENUE, CHELSEA.
TELEPHONE: Kensington 1140.
WIRE: "Dry Meters, London."
LEEDS:
9, DEWSBURY ROAD,
TELEPHONE: No. 2934.
WIRE: "Meters, Leeds."
MANCHESTER:
GAYTHORN METER WORKS,
EASTON STREET.
TELEPHONE: No. 6898 City.
WIRE: "Slot, Manchester."

R. & J. DEMPSTER, LTD. 54 & 2306 Manchester.
TAR, ASPHALT, OIL & COAL WASHER.
SOLE MAKERS OF THE
CONNAH'S QUAY.

RITCHIE
C.I. PIPES FOR GAS & WATER.
MIDDLESBROUGH.

REMOVE ALL GREASE

THEN USE

POMONA BLACK ENAMEL

ON COOKERS AND GAS-FIRES.

DONALD MACPHERSON & CO., LTD., MANCHESTER.

ARROL-FOULIS

Stoking Machinery

HYDRAULIC COKE PUSHERS

(HUNTER and BARNETT'S PATENT.)

WILL DISCHARGE A RETORT IN ONE OPERATION,

LARGE NUMBERS IN USE.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,

GLASGOW.

LONDON ADDRESS: 56, VICTORIA STREET, S.W.

[Illustrated Advertisement, Feb. 22, p. 394.]

SIMMANCE'S

INCORRODIBLE DEAD BEAT RECORDERS

Are BRITISH MADE and Accurate.

Comparison with other Recorders is invited.

Hundreds of ranges for any vacuum or pressure (Foul or Pure Gas, Air, Steam, Water, or Oil).

Sole Makers: **ALEXANDER WRIGHT & CO., LTD., WESTMINSTER.**

AGENTS: Australia—FYVIE & STEWART, 360, Collins Street, Melbourne; Canada—W. P. ROPER, 502, Merchants' Bank Building, Montreal.

GAS EXHAUSTING PLANT.

Fig. 531.

The above is an example of our recent practice for Exhausting Plants of large capacity; the Engine and Exhauster being both mounted together as shown, on a Cast-iron combination under bed, doing away with the necessity for expensive foundations, the two fly-wheels giving an even wear in the crank-shaft bearings. The Engine can be supplied of power suitable for driving another Exhauster to be coupled on the other side later on. The regulation by means of our Hydraulic Regulator and Equilibrium Throttle Valve is now brought to practical perfection, and we can guarantee its effectual working.

VALVES OF ALL TYPES AND SIZES. TAR, LIQUOR, AND WATER PUMPS.

COMBINED METER BLOWERS FOR OXIDE REVIVIFICATION.

THE BRYAN DONKIN COMPANY, LTD.

Head Offices and Works: CHESTERFIELD.

London Office: MILLBANK HOUSE, Wood Street, WESTMINSTER, S.W.

Chesterfield Telephone No. 84.
London Telephone No. 5858 Victoria.

Chesterfield Telegrams, "Donkin Chesterfield."
London Telegrams, "Donkin Vic. London."

JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXXXIII., No. 2755.] TUESDAY, FEBRUARY 29, 1916. [68TH YEAR.

EDITORIAL NOTES.

Coal Contracts and the Price Limitation Act.

FROM more than one quarter, we have received communications regarding the statement made by the Chairman of the Commercial Gas Company (Mr. W. G. Bradshaw), at the recent meeting of the proprietors, to the effect that the Directors had "actually contracted for a substantial "quantity [of coal] at a price considerably less than the "limit fixed by the Price of Coal (Limitation) Act, 1915." To this statement additional emphasis and prominence were given by an editorial reference in last week's issue. Those who have made communication with us upon the subject regard the statement as a remarkable one; and we have been asked what it really means, because, under the conditions generally ruling at the present time in the coal market it seems inconceivable that a contract could have been entered into for similar quality coals, in similar quantities, at a lower basis price than is provided by a contract entered into during the year ending on June 30, 1914. As a matter of fact, it is pointed out that the statement is altogether contrary to the experience of buyers who have been in the market for contract supplies, or who are in the market at the present time; and to them it is naturally strange if the Commercial Gas Company have been awarded preferential terms by any coal owners. It is, of course, impossible for us to go behind Mr. Bradshaw's words, and offer any explanation; but, as the matter has received such publicity, and we are assured is giving rise to some trouble and confusion between gas undertakings and their contractors, and is causing some inconvenience in the matter of negotiating coal supplies for the next twelve months, we hope that Mr. Bradshaw will, through our columns, make a statement which will remove all doubt regarding the matter.

Of course, the literal meaning of the original statement as made to the Commercial proprietors is that for "coal of "the same description, sold in similar quantities, and under "similar conditions affecting the sale at the pit's mouth at "the same coal mine," as was contracted for in the twelve months ending June, 1914, is being sold at a lower price per ton than then, *plus* the standard figure of 4s. Other buyers are told by colliery owners that they are purchasing coal as cheaply as anyone else, and that there must be something not disclosed in Mr. Bradshaw's statement which would explain it, either due to the nature of the interpretation given to section 1 of the Act, or to the manner of calculating the basis price. The impression in one quarter is that the asserted lower price per ton is due more to calculation than interpretation. For example, by taking the prices for 1914 and uniting them with the prices for another year, the price now being paid can be made to appear below the average of those years, and therefore below the price fixed by the Limitation Act. Another suggestion is that explanation might be found in the manner that the contracts are being dealt with. Was one contract for similar coal taken in fixing the basis price, or was the average of a number of contracts adopted? There we leave the matter, trusting that in our next issue an explanation will appear from Mr. Bradshaw.

The Gas Engineer—Prophecy, Foresight, and Position.

WE are living in times when the very best there is in a man is required of him. There is talk in tales of the "good "old days," when things are said to have been very comfortable and very easy-going, and when everybody enjoyed life, and was on exceedingly good terms with everybody else. The printed words and the actual facts may not have altogether truthful coincidence—at any rate, there is doubt when we apply to the then conditions the test supplied by the remarkable growth in later years of the conveniences of life, which are now regarded as being indispensable to human comfort and pleasure. There were also, in perhaps the comfortable and easy-going sense, "good old days" for the gas engineer. But simultaneously with the progress of conveniences and improvement in general living conditions, and advances in the methods of doing the work of the world, and enhancing productivity on all hands, the claims upon the individual have become more strenuous; and, in the competition in every walk of life and in every part of the world's affairs, the strenuousness is becoming, in normal circumstances, more and more intense. This was realized and spoken of before the war; and the best of thinkers were counselling preparation by every individual for the still more arduous times which would come through ordinary progress and development. Then the war broke in upon the normal conditions, interrupted them, and cast us and all our affairs and interests into a mass of irregularity of which no conception could have been fashioned in our minds. We repeat, we are living in times when the very best that there is in a man is required of him; and this applies to the gas engineer in common with others. Perhaps it might with truth be said that it applies to the gas engineer in excess of many others who hold responsible positions in the world's work; for the gas engineer has not only to conduct with the maximum possible efficiency the public service of gas supply, and look after the subsidiary products of gas manufacture, but he has to perform these duties under circumstances for which no precedent can be found, and circumstances that are the most refractory and hostile to the rendering of service in the most effective manner. Not only are the usual obligations upon him extraordinarily heavy, but he has to shoulder new responsibilities in connection with the provision of materials for the war; and simultaneously he must look well forward, unless he has no care as to the future of his concern.

In his Presidential Address on Saturday to the Manchester District Institution of Gas Engineers, Mr. E. A. Harman had a good deal to say about the gas engineer, and his part in administrative and engineering policy. The opinions expressed were broad and sound. Perhaps there is no class of men whose qualifications better enable them to deal more effectively than engineers with a complex situation such as the present, together with its possible bearings and effects, in view of the fact that, in all phases of the work of the latter, they have not only to look to the present but to the future. In looking to the future, we must distinguish between that which is prophecy and that which is foresight. No one deprecates attempts at prophecy more than we do; and no one more deprecates the neglect of the exercise of the best possible degree of human foresight. Right in the forefront of his address, Mr. Harman says: "There are not "wanting people who will tell us what will happen after "the war is over; but their prophecies may be discarded." No one can say positively what will happen after the war; nevertheless it is the business of each one to look forward. Though he does not prophesy, it is the part, it is the duty, of the engineer to measure the future in a discriminating fashion on the basis of prevailing conditions. One of the most important branches of his work in design is to provide not only for present requirements, but to make assessment of those within a reasonable distance in the future; so that they, too, may be met on the most economical and efficient lines, subject, of course, to unforeseen developments which may affect the position. Thus we suggest that care be taken not to misapply the term prophecy to foresight, which latter attribute in the gas engineer and manager is to-day one of incalculable value. The gas engineer who can best and reasonably assess future conditions by the guidance of current circumstances, and make provision accordingly, is the gas engineer who will show to greatest advantage when the war conditions have accumulated to the point of maximum severity, and when the new after-war conditions come upon his undertaking. Foresight, we repeat, is an indispensable qualification in the engineer; and it is a cardinal

essential to efficient management. It does not by any means follow that "the difficult times through which we "are passing" will "qualify for the exceptional opportuni- "ties of the future." Difficult times in the case of some people have an effect the reverse of that of qualifying them for exceptional opportunities. The "hard times" require to be supplemented by individual competence in learning and applying the lessons of such times. No form of experience would qualify some people for anything much; while others, with mental grasp and ability to project themselves beyond the pale of current environment, can make preparation to put to good use experiences, whatever the time and the conditions, in enhancing profit, or in reducing to the minimum the adverse effects of possible inimical conditions, should they mature.

Scattered through the address are seen the views of the President as to the high position that is the due of the engineer whose ability and qualification entitle him to the description. And the high position is as much the due of the gas engineer as of the engineer specializing in any other branch of the profession. But, somehow or other, though his accomplishments have to be of such a wide and varied order, and though all his ability and energies are at present strained to an extent never experienced before, the gas engineer appears to be relegated to a very indifferent place by those municipal authorities who put upon him heavy responsibility and discharge their consciences by rewarding him in inverse ratio. The President speaks from the platform of experience; and he will have full support for his plea, though indirectly expressed, that nothing shall be left undone to give the gas engineer his rightful place in recognition, and deserts according to professional merit. Greater consideration should be paid to municipal officials—generally, and not in the infrequent manner now seen. There is, as Mr. Harman says, true economy in well-recognized and well-paid service—always providing that ability warrants; and the recognition should extend to the conferment of greater freedom of control, such as is usually enjoyed, to the advantage of all concerned, by engineers in the service of gas companies. Further, Mr. Harman is still convinced, and time hardens his view, that an industry of the standing of that making and distributing gas, and producing other valuable commodities—an industry with such a large stake in the country, with such obligations, and of such indispensability—should have greater recognition and (worthy of it) a central home for its organizations. We have not the slightest doubt the industry is entering upon an enlarged service; and therefore all that has been said previously on these matters is accentuated by present conditions and prospects. Self-respect ought to ensure the doing of things, through constructive and defensive action, that have not hitherto been done.

Pitch and Naphthalene.

PITCH is a commercial difficulty, and naphthalene a working trouble, which, through extraneous causes produced by the war, bear heavily upon the gas engineer and manager. Both subjects were under discussion at the meeting of the Manchester District Institution of Gas Engineers on Saturday. In regard to pitch, the main question considered was the feasibility of restricting accumulations of stocks by carbonizing the substance to the extent of a small percentage of the retorted coal—a matter to which attention was directed last week. But there are gas engineers who are of opinion that a more profitable and permanent way, and a more suitable way for gas-works, to utilize pitch is by briquette making, for which machinery is available quite appropriate for incorporation in the subsidiary processes of gas-works. It is a boast that there is little or no waste on a gas-works; that practically everything that is produced has profit attaching to it. But if those things that are least valuable can be made more profitable, so much the better; and particularly if the additional profit can be obtained by improving the market position of another product of gas manufacture—pitch in this case—by diminishing the outgoing available supply. At the meeting on Saturday, there was no set paper on how best to deal with the pitch situation, but just a formal recounting of experiences and deductions, as reported to-day in other columns.

Regarding naphthalene, and the new interest engendered in it through the masterful way in which it has been raising serious objection to the application of the "C" process for the extraction of benzol and toluol from gas, Mr. Henry Simmonds, of Bury, presented an unpretentious paper, but one full of experience, and with no surplusage of words in it. The information covers a period of three years, in each of which a different method of combating the naphthalene difficulty was used; and the last tried now takes precedence in the estimation of Mr. Simmonds. It was a good discussable subject as presented in the paper, because there are the details of working and the results with the three processes precisely under similar working conditions, though not probably in respect of the atmospheric ones, about which nothing is said. The three processes are: The use (in 1913) of "Solvene" in a Livesey washer; the use (during 1914) of Russian vaporizing oil in a vaporizer, the connections being arranged to work either on the inlet or the outlet of the gasholders; and (in 1915) the atomizing of naphtha (sp. gr. ·770) with compressed air, and passing it direct into the town's supply. We admire Mr. Simmonds' perseverance in making working experiment with each process through the four seasons of a year until he obtained the one which gave him most satisfaction.

The first two processes do not at Bury give satisfactory results; the third shows great improvement. Yet there are engineers with the "Solvene" or the vaporizing methods in use who are perfectly satisfied with them. Were it not that in the middle year (1914), with the vaporizing process running, the stoppages recorded were higher than in 1913—3428 and 2162 respectively—one might have felt disposed to think that the atomizing process in 1915, when the stoppages were reduced to 1233 (although the "C" process had been introduced), was obtaining some benefit from the work done in the two preceding years. But this can hardly be claimed in view of the evidence of the data given. The naphtha used, 0·176 gallon per ton of coal carbonized, compared with 0·177 gallon of oil with the vaporizing process, and 0·202 gallon with the "Solvene." A very interesting fact is that the 0·176 gallon is only 0·028 gallon less than the toluol and benzol extracted from the gas; the extraction before the application of the "C" process being 0·110 gallon per 12,000 cubic feet, and with the "C" process 0·314 gallon —an increase of 0·204 gallon. The total cost with the atomizing process is only equal to 0·51d. per ton of coal carbonized, or 0·042d. per 1000 cubic feet—a small enough charge for the considerable relief shown, and one that must be about, or largely, saved by the economy produced in labour, let alone the greater freedom from annoyance of the consumers, and the better protection of the character of the gas supply. Details are furnished in the paper as to the mode of applying the process, and other information is afforded as to effects. Altogether it is a most opportune paper, and one that shows that cost is not a burdensome factor in the realizing of relief from a worry brought about by the introduction of the work now being done for the Government.

Paper and Economy—An Appeal for Co-operation.

MULTIFARIOUS are the effects of the war. They occur at every turn and in every direction. Technical and trade journals have felt them in many ways—an important one being the increased cost of production. Paper, printing, and labour have all caused expenditure to increase, and so has postage; but only in respect of postage have our readers been asked to render assistance. Now a fresh difficulty assails, and will possibly develop. The Government are about to limit the supply of paper for newspapers and other publications. Their intentions in this regard are of a serious order; and it may mean a reduction of the normal requirement of technical journals by at least one-third, and perhaps later on somewhat more. Anyway, last week there was issued a proclamation prohibiting the import of paper and paper-making materials; but this prohibition fortunately did not exactly mean what it stated. It subsequently transpired that a Commission had been appointed to grant licences for the importation of such quantity or such proportion as the Board of Trade may from time to time direct, and for the distribution of the imports among paper makers and paper users, on such terms as may appear to the Commissioners to be equitable. The one-third reduction in supply is the present view of the Government as to a "substantial reduction" of the imports; and Mr. Runciman has suggested to the Commission that conditions shall be attached to licences so that consumers shall receive two-thirds of their supplies on a standard year, which standard year is to be left to the discretion of the Commission. But there is a significant statement made by Mr.

Runciman, that a larger reduction than the one-third may prove possible; so that our future—the future of technical journals during the war—in regard to paper supply is very much in the hands of others. We are hoping, but the foundations for the hope are not substantial, that the worst fears in respect of supply may be unfulfilled, as the result of action that the technical papers are jointly taking in making representations in the proper quarters as to the certain harm that will ensue from the contemplated limitation. But the regulation of the allowance of paper to technical journals will necessitate measures to secure economy in use, and yet maintain, as far as possible, the intrinsic value to industries of their particular means of bringing together and communicating current information which more especially concerns them. In these measures of economy, we ask all to participate, who directly or indirectly, and in any form, make contribution to our technical and news columns.

The "JOURNAL" has always pursued the policy of giving to its readers reasonably full reports on all manner of subjects—recognizing that the topics that interest in the gas industry are many and more or less complex, and that readers have varied interests and qualifications. To cater for all readers and interests, it is difficult at times to hold the balance fairly; but we have preferred to err on the side of liberality rather than that any section of readers should feel that they are neglected, and that their interests are regarded as inferior to those of other sections. As a matter of fact, it is not always an easy matter to assign the relative position in importance of the variety of work that to-day makes up our industrial operations. However, reluctant as we are to depart from the policy that has been so consistently pursued, and which is generally appreciated, the now certain limitation, for the indefinite period of the war, of the supplies of paper puts on us the necessity of asking for the co-operation of contributors for the time being. We do not suggest there shall be any reduction in the number of contributions; what we do ask is that all contributions shall be made in the most concise form possible. When "contributions" are spoken of, we include reported utterances. Some chairmen of gas companies, when it comes to their "day out," are inclined to be a little exuberant in the presence of shareholders; and some shareholders, when opportunity presents itself for getting on their feet at meetings, are apt to become somewhat prolix. We ask them, in view of the exigencies of the situation and in the interests of economy, so far as paper supply is concerned, to confine their utterances to essentials, and to leave out the trimmings of superfluity. Some authors of papers, too, are apt to indulge in unnecessary detail, and so lengthen the statement they have to make, or the argument they have to advance. This has particularly been found in some of the papers read before the Junior Associations—many of them valuable papers, but their value would have been enhanced, and the number of their readers would have been enlarged, had they been judiciously curtailed. The same in discussions. Redundancy and complimentary remark, instead of a direct, terse statement upon the kernel of the contribution (which would be considerably more valuable), are too often found. By reformation in these and other ways, much can be done towards aiding the Technical Press in these days of pressure, and when the immediate limitation of paper supply will compel for a time a large withdrawal of the editorial clemency of the past. If, therefore, those who make contribution to the material for publication do not assist, it will be necessary, however much the action may be regretted, to exercise the editorial right of condensation much more liberally than hitherto. But willing co-operation will do much to save trouble, and to give satisfaction to contributors, writers of papers, and speakers.

While asking for this assistance, it must be said that, in the actual circumstances of the use of paper for general printing, we resent keenly the limitation of the freedom of the Technical Press through the proposed curtailment of its supply of paper. Were there less waste of paper in frivolous publications and prints of no real utility, and were there fewer editions of evening newspapers issued, we should have less ground for complaint. If Government Departments, in the use of stationery, and in their publications—such as blue books—were not such fine exemplars of prodigality, there would be less rebellious feeling over the suggested reduction of the paper supply to technical journals. But while, with a shortage, there is to-day such an enormous and useless expenditure of paper in the country, there is cause for this feeling. The Technical Press is, as a means of special communication, essential to the life of the industries of the country, though we must confess that the support of the Technical Press in times such as these when support is needed more than at any other is not recognized by some of the advertising units which are part and parcel of these industries, and which normally profit well out of them. But that point apart, the Government ought to appreciate, in connection with this paper question, that the vigour and usefulness of the journals ministering to the industries and to the trade of the country ought not to be in any way checked, or not more so than is absolutely imperative; for industry and trade are the real sources of the national revenues, and the maintenance of the supply of serviceable information to them is necessary to the upkeeping and the advancement of their efficiency. If the Government could be made to realize this, the present trouble could be much minimized. However, in the circumstances, the main thing that is desired is the co-operation in producing economy—at any rate, for the time being—of all those who make technical or news contribution to our columns.

Physical Photometers, and Freedom from Eye Errors.

Photometry has always been under suspicion and censure for being subject to the inconsistencies of human vision. But there is persistent work going forward in the laboratories of different countries to remove the stigma of inaccuracy due to a physiological cause from the science of photometry by establishing it on a physical basis, which, of course, is the ideal if certainty of result can be achieved. It is the natural tendency in physical matters (to quote Professor Fery) to devise methods of measurement which are independent of physiological processes. But the merit of the comparison of a standard light and the source of light to be measured, apart from all question of visual errors, is its simplicity; and we fancy that, even given a reliable physical photometer, it will take time in ordinary work to divert adherence from custom and old acquaintances to the new method. Prejudice and custom are hardened obstructionists. Of course, in those laboratories where scientific research work is carried on, a physical photometer of dependable character would soon gain entrance; and this is the view of Mr. Walsh, of the National Physical Laboratory. He says: "The physical photometer supplies a method which, it will be generally agreed, is rapidly passing through the experimental stage, and which in a short time will force its way into the photometrical laboratories all over the world." Information as to physical photometers will be found in a sketch given elsewhere in this issue of details brought out in a discussion of the subject by the Illuminating Engineering Society. There seems to be a decided leaning towards the class of physical photometers by which the radiated energy of an incandescent body is measured. Dr. Ives, of the Physical Laboratory of the United Gas Improvement Company, has been working for a long time on a thermopile physical photometer; and he says it is operating admirably in practice in the laboratory, which appears to be the only suitable place in which to employ it. There are, on the other hand, those who are a little dubious as to the ability to accurately measure illumination by a method in which a heat-measuring apparatus is employed. However, fresh interest is developing in photometry.

Benzol and Motor Cars.

The owners of motor cars feel convinced that, much as they regret the war, one result of it will be a larger supply of home-produced motor fuel; and therefore through the very thick cloud of war they see a little blessing. They are probably right as to the prospects of an enlargement of the supply of home-produced fuel. The ground of their belief is the information that is spreading among them that gas undertakings are doing for another purpose what they could never be prevailed upon to do before for motor fuel purposes only—extracting from their gas a quantity of benzol and toluol for the making of high explosives. The motor car owners are also learning that for the objects for which gas is now used, no one appears to be through the extraction of the benzol a penny the worse, though there were a short time since busybodies who tried to make out that what was not tangible to the consumer was something that should be so. Under the circumstances of present experiences, it is quite possible—it is quite feasible—that the washing process for the recovery of benzol will

be continued by gas undertakings, perhaps on a limited scale, after the war. If this is so, then the hopes of the motor car users will be fulfilled.

Coal and Coke Exports.

The returns as to the exports of coal in January show that the Coal Exports Committee continued their discriminatory control over the coal sent out of the country. The month's shipments amounted to 3,171,200 tons, compared with 3,612,963 tons in January, 1915—a reduction of 441,763 tons. In January, 1914, 5,794,770 tons were exported; so that in contrast last month was down 2,623,570 tons. France was still buying heavily; but Italy—this is not surprising in view of the weight of freights—was receding in her requirements. Its purchases were less by 360,000 tons odd than in January, 1914, and about 45,000 tons less than in January, 1915. The exports of coke last month amounted to 112,809 tons; in January, 1915, to 92,597 tons; in January, 1914, to 124,256 tons.

PERSONAL.

Mr. A. M. PADDON, M.Inst.C.E., has been appointed Chairman of the Hornsey Gas Company, in succession to the late Sir Hugh Owen, G.C.B., and the vacancy on the Board has been filled by the selection of Mr. FRANK H. JONES, M.Inst.C.E.

Much sympathy will be felt with Mr. William Garton, the Chief Accountant to the Nottingham Corporation Gas Committee, at the bereavement he has sustained by the death at the front of his grandson, Mr. WILL GARTON, of the 10th Sherwood Foresters. Deceased was among the first recruits in Nottingham for Kitchener's Army. He had been in the service of the Nottingham Water Committee.

Major ARTHUR BRAY, of the Royal Engineers, who has been awarded the French Croix de Chevalier of the Legion of Honour, is the head of the firm of Messrs. George Bray and Co., of Leeds. He joined the Leeds section of the R.E. in 1902, and went to the Dardanelles last April, where he was put in command of the General Headquarters Signal Company. He was invalided home last August, and is at present recuperating in Devonshire.

OBITUARY.

Sir G. LAURENCE GOMME, whose death occurred last week, was for many years well known in connection with the work of the London County Council, into whose service he passed from that of the Metropolitan Board of Works. A quarter-of-a-century ago he was appointed Statistical Officer to the Council; and in 1900 he was appointed Clerk. The latter position he retained till 1914, when he retired, on medical advice. Deceased was an acknowledged authority on London from the historical point of view.

Another member of the automatic meter staff—the third in the department—of the Manchester Corporation Gas Department has just fallen in the war. This is Corporal WEBSTER, who had fourteen years' experience in the stores and cash collecting branches, and who was held in high esteem by all his colleagues. He was killed in action in France on the 10th inst., while serving with the 18th Battalion Manchester Regiment. Altogether 620 employees of the Gas Department have so far volunteered for service with the King's Forces; the casualties being as follows: 16 killed, 29 wounded, 3 missing, and 4 prisoners of war—total 52.

A great loss has been sustained by the Tottenham District Light, Heat, and Power Company through the death, which took place last week, of the Secretary, Mr. E. TOPLEY, who had, by his cheery nature, lovable disposition, and splendid patience under many years of anxiety and ill-health, so much endeared himself to everyone that he will be greatly missed for a long time to come. In fact, in the course of a sympathetic letter, Mr. A. E. Broadberry (the Engineer of the Company) says that during the whole course of their business connection, he found working with Mr. Topley was an absolute joy. Deceased had held the position of Secretary at Tottenham since 1907—having been promoted from the position of Assistant-Secretary on Mr. James Randall's retirement in that year. He was the younger son of Mr. William Topley, of Woolwich, and spent the first few years of his working life at Somerset House, in a department of the Inland Revenue. But this employment did not afford sufficient scope for his energies, and he resigned to join in business his father and elder brother. The eldest brother was Mr. W. Topley, F.R.S., of the Geological Survey, father of Mr. William W. Topley, Secretary of the Croydon Gas Company. For thirty years Mr. Topley led a strenuous life in that business, succeeded by a few years with another firm, after which (some ten years ago) he entered the service of the Tottenham Company. His only surviving son is Dr. W. W. C. Topley, of Harley Street.

The next meeting of the Coke-Oven Managers' Association will be held at Leeds University on the 25th prox., when Professor John W. Cobb will lecture on "Refractory Materials and Salty Coals."

ELECTRICITY SUPPLY MEMORANDA.

THERE is no occasion to gloat over the war misfortunes of electricity supply companies. Gas undertakings have quite enough of their own to bear; and their administrators are sympathetic people. But we cannot help remembering now, as tales of diminished electricity profits and reduced dividends are unfolded, and as we see the price for current being further raised practically everywhere, how some of our bosom electrical friends made, in the early days of the war, strange comparisons of the relative increases in the prices of gas and electricity—of course, on paper to the advantage of electricity supply, without taking into account the not unimportant factor of value received for money expended. Now a different tale could be told by them. Last week we showed how the net earnings and the dividend paid by the St. James' and Pall Mall Electric Light Company had had a down-hill slip. Other accounts have since been published; among them those of the Westminster Electric Supply Corporation. In 1912, the available balance of this concern was £36,187; in 1915, £23,518. The dividend in 1912 was 10 per cent.; in 1915, 7 per cent. The carry-forward in 1912 was £7703; in 1915, £1518. These are substantial differences. The Chelsea Company are proposing a dividend of 4 per cent., as compared with 5 per cent. in 1914. When the dividends of electricity companies are compared with those of gas companies, it must not be forgotten by our electrical friends that, in most cases, the stocks of gas companies have been converted on (variously) from 3½ to 5 per cent. bases, with the sliding-scale applying. One other point. In addressing the shareholders at the meeting of the St. James' and Pall Mall Company (whose reduced profits and dividend, as mentioned above, were noticed last week), Mr. Walter Leaf remarked: "With regard to the future, I shall make no prophecy of any sort. We are entirely dependent upon the course of the war. If the war stopped to-morrow, I have no doubt we should soon step back into our previous prosperity; but so long as the war continues, there is no obvious reason why profits should improve." As to what would happen if the war stopped to-morrow, Mr. Leaf is perhaps a little too optimistic. The costs of coal, materials, goods, transport, labour, and taxes are not going to tumble back swiftly into their former state; and these are the expenses that govern electrical profits.

The Slide Down Hill.

Allusion was recently made to the proposals at Brighton whereby existing charges for the supply of electricity by the Corporation Electricity Department were to be abolished, and flat-rates sliding downwards according to quantity were to be adopted. The recommendations of the Committee (which were referred back to them by the Council) were that to all users other than power consumers the charge should be for the first 1000 units 5½d. per unit, with a reduction of ½d. per unit for each 1000 units beyond, until for all consumption over 4000 units 3½d. per unit should be paid. Prepayment consumers within the borough were to be charged 5½d. per unit; the unfortunate ones outside the borough, 6½d. There was in the Council some objection to the charge, on the ground that the large consumers would receive undue preferential consideration; there was also criticism of the fact that power consumers were to be let off scot-free. The reference back has not caused the Electricity Committee to alter their determination as to the lighting consumers; but they have decided that the flat-rate for electricity supplied for power should be increased from 1¼d. to 1½d. per unit for the first 2000 units, and for larger use 1¼d. per unit. This alteration compares with an advance from 1·35d. to 1·4d. per unit for tramway purposes; so that the ordinary power consumer above 2000 units is better off than the tramways. No alteration is proposed in the 2d. per unit charged for street lighting. Then it will be remembered that there was some discussion as to the Electricity Committee being allowed from the district fund a sum of £2000 per annum for interest and sinking fund charges in respect of the proportion of generating plant, including land, buildings, trunk mains, and machinery required for street lighting, in regard to which the unextinguished debt is estimated at £25,000. This was a very artful move; the Gas Company receive no such consideration. The Electricity Department would not, however, voluntarily relinquish the whole of their claim, but reduced it to £1250 per annum, credit being given against the contribution for all current used for street lighting. When the reconsidered report came before the Council, it was made clear with unblushing candour that the Electricity Committee are opportunists of the first water. They are taking advantage of the war to get out of a tariff muddle. The existing conditions were spoken of as a "pandemonium of tariffs," and as "inequalities;" and Mr. Lintott, who moved the adoption of the report, "urged the Council to take the opportunity of doing away once and for all with the endless anomalies and the complicated scale of charges they had suffered from so long." The upshot was that the proposed lighting tariff was adopted, with the modification that the minimum charge was fixed at 4d. per unit for 4000 units and upwards; but the question of the £1250 contribution towards loan charges in connection with the street lighting was referred back. The Finance Committee have the point under consideration, so that possibly more may be heard of it.

The Brighton Charges.

Of Unknown and Mysterious Origin.

Fires of unknown and mysterious origin seem to have greatly increased in number since electricity has been introduced into our daily life. But even if an electrical main is found to be burned and all other testimony points to a fire having had electrical birth, one must not ask a Court of Law to accept these things as sufficient evidence of electrical misdoing. That is what Mr. Edward Price, the proprietor of the Royal Laundry, at Shepherd's Bush, has found. He had a fire on his premises, which he alleged to be due to the electrical installation of the Hammersmith Borough Council; but the Council disclaimed all liability. The fire broke out in the laundry sorting-room, where the service-main entered the fuse-box and meters, which were connected at a point where the plaintiff's own wires began. The issue was, Did the fire commence on the defendants' or the plaintiff's side of the fuse-box? Mr. Justice Rowlatt was not satisfied that the evidence showed where the fire originated; and he felt bound to wash his hands of the whole affair by saying: "It is a fire which must remain, in my judgment, one of unknown and mysterious origin. I know quite well where there is apparently no external cause of a fire, and there is electricity in the place, and the service-main is found to be burned, that one is apt to say that it must have been the electrical current which started the fire. But this is only guessing; and I do not think that I am entitled to adopt that intellectual process." Sometimes common sense, and not "guessing," is applied in such cases.

Occasional Cessations.

There are many cessations of electrical current that are not reported in the Press; but good representative samples do find their way into public notice. It really matters very little to a local concern whether or not an occurrence of the kind gets "into print;" but there seems to be a deeply rooted objection on the part of electrical engineers and members of electricity committees to seeing the black and white record staring them in the face. The fact of the collapse they apparently regard as sufficient punishment; for throughout the area of affected supply, the electricity consumers know what has happened, and do not forget to talk about it. We have recently had the unpleasant task of calling attention to a number of electrical breakdowns; but among them we do not find chronicled certain happenings at Bristol. Perhaps these have been kept out of the local Press. However, at a recent meeting of the Council, there was some criticism of the "occasional cessation" of the supply of current. The pertinent inquiry was put to Alderman Pearson, the Chairman of the Electricity Committee, as to whether anything could be done to ensure a better and more reliable supply of current. The Alderman started off by referring to the loss of efficient hands, and to the inefficiency of the new hands; and then a little later it was learned from his remarks that "two recent accidents had occurred through machines burning out." There was not much consolation to be extracted from Alderman Pearson; he has resigned himself to the fact that "nothing can stop occasional accidents of this character." Those who are weighing-up the consequences of adopting electricity will bear this in mind. At Hampstead on Dec. 15, there was a breakdown of a 1000 KW. turbo-alternator through an open circuit occurring in the shunt-windings of the exciter. It appears that, on switching-out the machine on the high-tension main switchboard, the switch failed to break the circuit. Results: The switch was entirely burnt out; a fire was caused on the main switchboard; the switchboard has been condemned as being of obsolete pattern; and an urgent order has been despatched for a modern one.

Raid Warnings.

The electricity consumers of Manchester are while the war lasts to live in nervous anticipation of evil. In those electrically lighted houses where the occupants suffer from the fear of Zeppelins, the evening will be spent in watching the electric lamps for the five to ten minutes' fit of spasms to which they are to be subject when Zeppelins are reported. In the event of air raids, the supply of electricity is to be interrupted; and, as it is fit and proper that coming events should cast their shadows before them, the impending interruption of supply is to be notified by alternately raising and lowering the pressure several times for a period of five to ten minutes before the complete shutting-down of the power house. The electricity consumers will have an enjoyable time while the signalling is proceeding, and afterwards while sitting in the dark, or in the effulgence shed by a candle, listening for the dreaded bombs to drop.

Tragic Results of Amateur Work.

On previous occasions, people have had unhappy endings to their careers in electric-baths owing to shock. A 16-year-old lad, named Roper, met with his death the other day, at his parents' house at Sheffield, through an electric shock (the voltage was about 200) owing to an electric lamp falling into the water in which he was having a bath, and causing it to "become alive." From the water through the body of the bather the circuit was completed (it was thought) by going through the taps at the end of the bath. The lamp, it was stated, was fixed by the deceased's brother, who was an amateur at electrical work. At the inquest, the Coroner (Mr. J. Kenyon Parkes) commented on the fact that there did not appear to be any regulations to prevent people making unauthorized connections to electric light fittings. He thought this tragic incident should be a lesson to people not to interfere with electrical work.

Enemy Goods.

The British electricity supply industry has notoriously been a devoted patron of what are now enemy countries. But it has relented; and there is a devout intention now to show better and more patriotic behaviour in future. The Association of Municipal Electrical Engineers have passed a resolution recommending that, as a means of avoiding the possibility of purchasing articles of alien enemy manufacture, the Government should compile and publish an authoritative list of the firms concerned in the supply of these goods. Probably there are not many firms here engaged in such supply to-day, but there may be several of them who will be after the war. Perhaps the resolution is intended to be retrospective; the list comprising those firms who were engaged in the sale of enemy goods before the war. If this is the case, then, in view of the shortage of paper, and the threatened still greater shortage, it would be an economy to adopt the course of printing a list of those firms who were not prior to the war trafficking in goods made in the countries with which we have now rather a serious disagreement. The Association of Municipal Electrical Engineers should alter their resolution accordingly.

Dublin Electricity Affairs.

It is a long time since we had anything to say in the "Memoranda" about electric affairs in Dublin; but thoughts now revert to those times when there were innumerable rows in the Council over the big "white elephant" that the city had in their electricity undertaking. Then when the Chairman of the Electricity Committee was able to proudly announce that the concern had financially "turned the corner," the gratification became great. But, in some quarters, there were doubts as to the validity of the claim when all the financial aspects were marshalled and examined. However, with all the pushing since, there has not been much progress past "the corner;" and again there is dissatisfaction. A short time ago, a Special Investigation Committee were appointed by the Corporation to look into the affairs of the Department; and Mr. P. Walter d'Alton, M.Inst.C.E., M.Inst.E.E., was called in to report upon the concern. He does not think much of what he found. Administration is complicated; charges for energy for private supply are unduly high; the number of men employed at the Pigeon House station could be reduced by the use of more modern machinery; the salary and wages in the public lighting department appear to be out of proportion to the revenue; the cost of the secretarial and managerial department is high; the system of coal supply wants carefully overhauling; further capital must be expended on the generating station; the returns of the units generated are unreliable, owing to the defective and dirty condition of the meters; some of the engines are obsolete and extravagant; the condensers are now, and have been for some time, ineffective; and he refers to the boiler-house as being rather an exhibition than the serious centre of a generating station. This seems all very bad, until confusion is generated in the mind by reading the comments upon the report made by Mr. Fred. Allan, the Secretary and Manager, and Mr. Mark Ruddle, the Engineer. The former alleges that Mr. d'Alton did not once visit the Sales Office; and as to the rates charged for private supply, those who had changed from gas to electricity for either light or power had in every case saved money. This is remarkable. Nevertheless, Mr. d'Alton, we gather from Mr. Allan's report, seems to think the managerial part of the secretarial department might be wiped out altogether. This, of course, Mr. Allan resents—not seeing why his "job" should be given an unhappy despatch, or even be reduced in any way. Mr. Ruddle does not think the charges are high, having regard to the price of gas and the cost of steam-raising fuel. He gives the interesting information that during the year ended March, 1915, 3,844,800 units sold for power purposes produced an income of £20,024, while 4,261,200 units sold for private lighting produced £72,300—that is to say, of the total units sold for private lighting and power, 53 per cent. sold for lighting produced 78 per cent. of the total income; while 47 per cent. sold for power produced 22 per cent. of the total income. Mr. Laurence J. Kettle is the Deputy Electrical Engineer; and he also has a slap at Mr. d'Alton, and leaves his mark. The expert suggested that the new Oerlikon 3000 KW. engine at the power station should have been run through practically the whole of 1912-13. Mr. Kettle's comment leaves no manner of doubt as to his view of Mr. d'Alton's judgment upon this point. In the opinion of Mr. Kettle, it would have been "sheer lunacy" to have gambled with the safety of the supply in the "irresponsible manner" suggested. We hope the Special Investigation Committee will be able to arrive at a sane conclusion from the four reports. To do this, if they are all laymen in electrical matters they have their work cut out.

Prohibited Exports.—By an Order in Council made on the 23rd inst., the exportation was prohibited to all destinations of oxide and salts of cerium, and cerium and its alloys (except ferro-cerium). The exportation of ferro-cerium is prohibited to all destinations abroad other than the various British Possessions and Protectorates.

ESTIMATION OF BENZOL IN COAL GAS.

In its issue for Feb. 20 the "Journal des Usines à Gaz" takes up the question of the methods of estimating benzol in coal gas, in reference to the recent note by Dr. C. Neubeck, the Chemist to the Hibernia Westphalian mines, wherein the German author described his method as a modification of that of Sainte-Claire Deville, and both more convenient and exact than the latter's. This claim leads our French contemporary to review the methods which have been employed in France for measuring the benzol content of gas. The article, of which the following is a translation, while refuting the claims of Dr. Neubeck, incidentally records the comparative value of methods for estimating benzol which have been thoroughly tested in France for many years past.

From 1881 the method employed by the experimental department of the Paris Gas Company was to determine the weight, P, of benzol which condensed from one cubic metre of gas at the temperature (— 21° C.) of a mixture of ice and salt. The gas, after passing the cooling chamber, then contained only the benzol required to saturate one cubic metre of gas at — 21° C., a quantity which was taken to be susceptible to very slight variations. Calling this constant quantity K, the total content of benzol in one cubic metre of gas is K + P. Variations in this total figure, in examining different gases, were taken as due almost entirely to variations in P. In 1880, the use of methyl chloride allowed of a temperature between — 70° C. and — 80° C. being obtained. Experiments on air charged with a known weight of benzene and on eighteen samples of coal gas of different qualities, showed that at — 70° C. the vapour tension of benzol is *nil;* also the quantity K (benzol left in gas at — 21° C.) is, as was supposed, subject to slight variation, and can be taken at 23·5 grammes per cubic metre —a figure agreeing almost exactly with Regnault's measurements of the vapour tension of pure benzene at — 21° C.

From 1884, the analytical reports of the Villette experimental works recorded not only the quantity, P, actually condensed at —21° C., but P + 23·5 as "benzol per cubic metre of gas." This benzol vapour was further taken as having the same density as a mixture of three-quarters benzene and one-quarter toluene—bringing the weight of 1 litre to 3·73 grammes; and so the volume percentage of benzol vapour in the gas was obtained by dividing P + 23·5 by 3·73.

In opposition to the statement by Dr. Neubeck, actual condensation at — 21° C. takes place very readily. Since 1884, the determinations made daily at the Paris experimental works have reached a total of from 15,000 to 20,000. The method is obviously inexact when the benzol falls below 23·5 grammes per cubic metre. Such a low content, however, is never met with in ordinary working; it occurs only in gas taken at the end of a charge, or if there has been a special removal of benzol. It was on this account that the experimental department of the Paris Company, in studying in 1891 the variations in the benzol content of gas produced at different stages of the distillation, employed a low temperature in the condensation of the benzol from the gas under test.

Since the previous low-temperature tests had been made in 1884, liquid carbonic acid had come into industrial use, and the method now re-invented by Dr. Neubeck, of using a mixture of solid carbon dioxide and ether, was employed. As regards accuracy, the results were very good; and the idea was entertained of using the new method regularly in place of the old one. Comparative tests of both methods on all the samples of gas examined in three months showed, however, that the results differed by little more than the negligible amount of 3 to 4 per cent. At this time, the Dewar vacuum flask was not available; and the maintenance of the carbonic-ether mixture for the necessary time called for much supervision. Hence it was decided that the slight gain in accuracy was not enough to compensate for the greater labour and expenditure of time.

In 1913, the matter came up again on the publication of Lebeau and Damien's work on the analysis of gas by condensation at the temperature of liquid air. A series of experiments was planned, among them an examination of the measurements of benzol in gas by cooling with carbonic snow, but according to a much simpler method made possible by the use of the Dewar flask. The war has greatly interfered with the full course of these researches; but the part relating to the estimation of benzol had to be carried out when, towards the end of 1915, it became necessary to control the extraction of benzol on the large scale from gas for the manufacture of explosives. The method adopted, and in use at present, was exactly that of 1891, save for the employment of the Dewar flask.

For an ordinary test, a very small refrigerating tube is contained in a Dewar flask of cylindrical form, measuring 35 mm. [1⅜ inches] in diameter by 100 mm. [4 inches] deep. From 25 to 30 litres of gas are passed at the rate of about 10 litres per hour—a displacement apparatus being used for its measurement. If the object is to collect considerable quantities of benzol for examination by fractional distillation, a much larger apparatus is used, involving a correspondingly greater consumption of carbonic acid. In this case, it is advisable to place in front of the carbonic refrigerator one of ice and salt. A preliminary fractionation of the condensed liquid is thus obtained, and this facilitates the further analysis.

The foregoing notes have intentionally been confined to the means employed for ensuring accuracy in the tests without recourse to the needless complications introduced by Dr. Neubeck. A future occasion on which the latter can be examined may present itself. Meanwhile, concludes the author of the article, it is sufficient to point to the process as an example of the rapacity with which German chemists coolly appropriate the authorship of inventions and ideas which become known to them from the works of scientific men in other countries but which, in their high estimation of themselves, they affect to ignore.

BRITISH INDUSTRIES FAIR.

Visitors during last week and this week to the Victoria and Albert Museum, South Kensington, where the British Industries Fair is being held, will doubtless approve of the reply given by the President of the Board of Trade to a question some days ago in the House of Commons—that it is the present intention of the Board to hold a fair of this character in the spring of each year. The one now opened is the second of the series; and it was arranged at the unanimous request of last year's exhibitors. The trades included were limited to very few, in order that the manufacture of munitions and other Government supplies should in no way be interfered with. But in spite of this there was a large demand for space. Admission is by invitation, which is, of course, confined to traders; and the attendance is good, with (judging from what one sees) a very fair number of inquiries. It is quite likely the results from a business point of view may not in all cases be of the same degree of excellence; for some "lines" will naturally be more in demand than others. But, anyway, taking the exhibits as a proof of what British manufacturers can do in the particular trades represented, there is ample ground for satisfaction on the part of all patriotic people. The visitor can hardly help feeling that, with proper encouragement, firms in this country will, in many directions, be quite as well able as others to supply requirements for the meeting of which it has too frequently been the custom to look elsewhere. The Victoria and Albert Museum is not the most convenient possible place for such a display, as the exhibits are somewhat scattered, and in some cases the passageways are rather limited; but it is the best accommodation that was available, and the Board of Trade have minimized confusion by issuing with the catalogue a plan showing the arrangement of the stalls.

The glass section, in quality of workmanship and variety of articles shown, is in no way behind the others; but though there are to be seen many excellent patterns of shades, &c., this class of goods by no means predominates. Scarcity of labour and pressure of work upon those who are available, prevents the glass firms from extending their activities as they would wish to do; but this is a matter that will in time right itself. The catalogue names the following exhibitors under the heading of "Lighting Glass:" Messrs. A. M. Allan and Co., of Glasgow; Messrs. Burtles, Tate, and Co., of Manchester; Messrs. A. & J. Davies, Limited, of Stourbridge; Edinburgh and Leith Flint Glass Company, of Edinburgh; Glass Sundries, of London; Messrs. Greener and Co., of Sunderland; Messrs. Molineaux, Webb, and Co., Limited, of Ancoats, Manchester; New English Glass Manufacturers, Limited, of Tipton; Messrs. H. G. Richardson and Sons, of Stourbridge; Messrs. Stevens and Williams, Limited, of Brierley Hill; and Messrs. Stuart and Son, Limited, of Stourbridge. A branch which the Board of Trade point out provides an example of notable improvement on previous work is the preparation of laboratory glass. It seems that when, on the outbreak of war, the supplies of Jena glass were cut off, firms supplying laboratory glassware formed themselves into an association with the object of encouraging the turning out of ware equal to that of Jena, so as to meet the demand in this country. The Association drafted up a formula, which compared well with the Jena formula, and then induced glass manufacturing firms to undertake to make the new ware—the results obtained being quite satisfactory.

A High Temperature Refractory Brick.—Stating that very good results have been obtained at an American ironworks by the use of a novel form of patent metal-cased magnesite brick, the "Iron and Coal Trades Review" remarks that it seems rather strange that the heat resistance and durability of magnesite should be increased by covering blocks of that material with such a comparatively fusible substance as sheet iron. Careful tests, however, extending over a period of two years, appear to have demonstrated that blocks of this construction used for very large basic furnaces have shown a durability at least two-and-a-half times as great as that obtained under similar conditions from the best ordinary magnesite bricks. The external casings are made of sheet-iron or steel, No. 18 to 20 gauge, pressed into rectangular shapes with dimensions corresponding to the bricks usually employed. The metal casings are electro-welded or riveted along the joint; and both ends are left open. The moulds thus formed are packed with damp magnesite. These rectangular bricks may be built into the furnace dry. Suitable lengths of old boiler tubes, not more than 3 inches outside diameter and ⅛ inch thick, may be used in place of the rectangular casings. These pipe bricks, after being filled, require to be laid in a mortar of magnesite when being built-in. For filling the bricks Grecian magnesite is preferably used. The bricks or pipes have a melting point of about 3500° Fahr.

THE EVOLUTION OF THE MODERN CHARGING AND DISCHARGING MACHINE.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

No unit of plant in the equipment of the modern gas undertaking has made more rapid strides into favour during the past few years than has the electrically operated stoking machine, whose advent has been largely the means of sweeping away old prejudices and conservatisms and of marking the beginning of a new era in gas-works practice. It has been stated that the extended use of the overhead transporter and the mono-rail telpher has been largely responsible for the introduction of electric power into gas undertakings; and while this may be correct in a few isolated cases, there is little doubt that in the great majority of works employing electric power plant the decision to use an electrically driven stoking machine has been primarily responsible for the laying-down of such an installation.

In placing the most important unit of his plant under the electric drive, the modern gas engineer has shown a degree of impartiality and broad-mindedness which might well be emulated by the many carping critics who, in their biased enthusiasm for things electrical, have for years made themselves ridiculous in the Technical Press by their erratic attacks on every phase of the gas industry, and whose parrot-like cry, "Gas must go," has only lately been silenced by their unwilling recognition of the vital part which the gas industry is playing in the present war, and of the stern fact that the fate of their country practically depends upon the efforts of those industries whose characteristic is the production of bye-products which may be utilized for the manufacture of high explosive shells.

The electric motor, by reason of its characteristics, possesses advantages over practically every other type of power generator; and for no purpose is it more admirably adapted than for the operation of the machines forming the subject of this article. By its adoption the gas engineer demonstrates the fact that he has a wide grasp of the principles of the economic application of power and of those principles by which power, intelligently converted to a suitable form, may be economically applied over a large area of operations. He does not weaken the case for the gas-engine; rather does he strengthen it by the use of an actual piece of substantial evidence that, by the application of his own product, he can (as can any of his consumers) generate whatever current he needs at a much lower cost per unit than that at which his competitors could supply it from their mains.

Electricity cannot be manufactured, in the true sense of the word. Energy, latent or active, is always with us; and it is in our hands to apply it to the best advantage. We cannot make it; but we can change its form. If we can apply mechanical energy direct, there is no sense in converting it into electrical energy; but if, on the other hand, such conversion would enable us to transmit a given power over a given distance at a cheaper rate per B.H.P. hour than would be possible by employing a purely mechanical method of transmission, it becomes apparent that the most business-like method is to convert our power into electric energy and reconvert to its original form at the far end of our transmission line. By this system we have to face three sources of loss in power—namely: (1) The loss in the dynamo in the conversion of mechanical to electrical energy; (2) the loss in transmission of our power between the point of conversion and the point of application; (3) the loss at the point of application in converting the electrical energy back into mechanical energy.

In the operation of stoking machines the very nature of the machine and of its duties renders it imperative that the driving energy should be delivered to the machine in such a form as to be capable of conversion into mechanical energy with the least possible loss and the greatest attainable amount of simplicity. The modern stoking machine is the outcome of a vast amount of experience which has proved that these conditions can be most efficiently met by the generation of electrical power by means of a gas-engine, and by the use of a motor or motors on the machine itself for reconverting the electrical energy so generated into a mechanical form. The dynamo, transmission lines, and motor or motors, are merely so many connecting links between the shaft of the gas-engine and the stoking machine by whose means the mechanical power generated by the gas-engine is applied to the operation of the various motions of the machine; and while loss of power is unavoidable in any system of power transmission, experience has proved that the electrical transmission of power to such machines gives a degree of simplicity, efficiency, and flexibility afforded by no other system of power application.

For many years pneumatic and hydraulic power held the field for the operation of these machines, but latterly the application of the electric drive has become universal. The experience of all large engineering undertakings has proved that, properly applied, the electric drive may, so far as technical considerations are concerned, be advantageously applied to any machine; but in very few cases does it show to greater advantage than in that of the stoking machine. It is obviously impossible to deal with the many lines along which this machine has been developed and improved upon during the last few years; and in this article the writer proposes to deal largely with the development of the multiple motor machine, and with a few of the points by which the prospective purchaser may allow himself to be influenced in his choice of a machine.

The stoking machine has progressed along very much the same lines as the electric crane, in which machine it is now generally recognized that the expense of installing three or more motors is more than counterbalanced by the increased convenience of operation, the lower maintenance charges, and the elimination of expensive and power-wasting gearing. The expense of installing three motors, with their control gear, is not so great as may be supposed, as it must be remembered that this practice enables a large amount of expensive gearing to be dispensed with; while, further, the employment of such gearing constitutes a constant charge upon the plant, on account of the power expended in operating it.

Three motions have to be provided for in a machine of this class—namely: (1) The travelling motion for the traversing of the machine up and down in front of the retort-benches; (2) the elevating and lowering motion, for adjusting the vertical height of the inner frame to the particular tier of retorts with which it is intended to deal; (3) the stoking motion, in which designation is included the charging and discharging machinery in a machine of the combined type, or the fire element which carries out these two duties in the simultaneous type of machine.

As in the case of the electric crane, there was in the early stages of the development of this machine a tendency to use one motor for all three motions, and to engage it with whatever motion it was desired to operate by means of an elaborate lay-out of interconnecting gears and clutches. While the ingenuity displayed in the general lay-out of such gearing cannot but be admired, time has shown that most of this constructive skill might have been better applied in other directions. The problem of providing this interconnecting gearing becomes all the more complex when it is remembered that the inner frame of the machine on which the stoking gear (and sometimes the elevating and lowering gear) is situated has a vertical travel relative to the outer or main frame in which it is suspended, and mechanical compensating means have to be provided whereby the power from the single motor can be transmitted between the two frames at any point of the vertical travel of the inner frame. Mechanical means, of a sort, can be, and have been, provided; but the author has no hesitation in expressing the opinion that mechanical power can only be transmitted between the two frames at a considerable sacrifice in efficiency of this important motion, to say nothing of the host of undesirable mechanical complications which this arrangement entails.

The Development of Multi-Motor Machines.

The following are the reasons which have caused manufacturers to turn their attention to the development of the multi-motor machine.

A.—The more gearing is used the greater will be the backlash as the gearing becomes worn, and the greater will be the shock to the machine as a result of the speed which the motor will attain before the backlash is taken up.

It may be argued that a careful operator will so handle his controller as to take up all backlash before starting an operation. But the writer's experience is that such an operator is a *rara avis;* and the engineer who relies upon the care of the average operator to mask a weak point in a machine is leaning upon a rotten stick. Sheared keys, broken shafts, and stripped gears are commonly caused in this manner; and the immunity which the two or three motor machine enjoys from troubles of this kind is alone a sufficient reason for its extended adoption. The efficiency of a drive is inversely proportional to the amount of gearing used between the motor and its objective; and a single-motor machine is necessarily inefficient on all its motions on account of the interconnecting gearing. In the three-motor machine, on the other hand, there is no gearing whatever with the exception of that necessary to reduce the speed of the motors to the figure at which it is required to operate the different motions. As a consequence, the loss between the motors and their respective loads is reduced to a minimum.

B.—Whether a two or three motor machine is operated by a separate controller for each motor, or by a master controller and a change-over switch, the change from one motion to another is performed instantaneously, and without the delay which is unavoidable when heavy positive clutches have to be engaged and disengaged. The time needed by a single-motor machine to take up its position in front of a retort and move away from it after the charging or discharging (or combined) operation, is much longer than would be occupied by a machine fitted with an independent travelling motor, even assuming that the clutches of the former machine were in first-class condition.

In practice these clutches become clogged with accumulations of oil and coal dust, and are often very heavy and difficult to operate and the cause of much gas being wasted before the machine can get clear of the retort and allow the door to be closed. In order to grasp the heavy duty which falls upon the clutches of a single-motor machine, let us follow in detail the cycle of operations through which a single-motor simultaneous type of machine passes in handling a horizontal line of retorts, assuming that the setting of the retorts is sufficiently accurate to permit of the machine charging the entire line without having to alter its vertical

adjustment—that is to say, without the necessity for the raising and lowering gear to be engaged.

Moving down from the berth to the first retort to be charged, the driver will perform the following cycle of operations: (*a*) Disengage the travelling gear, (*b*) engage the stoking gear, (*c*) disengage the stoking gear, (*d*) engage the travelling gear and move to second retort, where the same cycle of operations will be gone through. Summarizing, the travelling and stoking clutches have to be operated twice in dealing with each retort.

Assuming a house of sixteen benches, nine retorts to a bench, working on eight-hour charges in full work, this means that in the course of the twenty-four hours the travelling and the stoking clutches will be both disengaged and engaged 288 times; in other words, in this time there will be 1728 clutch operations, accompanied by 1728 shocks to the gearing of the machine, unless the operator happens to be an unusually careful class of man. This figure is based on the assumption that the operator brings his machine to a standstill accurately in front of each retort, and that there is no need for him to get back to his travelling gear to make a final adjustment when entering the mouthpiece. Miscalculations in this respect are of frequent occurrence; and it is far more likely that the stoking and travelling clutches would be operated from 2000 to 3000 times a day than the theoretically correct 1728 times. Neither do these figures take into account the using of the raising and elevating gear, which, in the case of badly lined-up settings, might easily account for a much larger number of clutch operations.

Such engagement and disengagement of positive clutches cannot in practice be carried out without edging the controller—that is to say, throwing the controller handle from one side to the other from its off position in order to either free the clutches or to line-up the respective halves prior to their engagement; and this edging is invariably accompanied by destructive arcing at the contact points of the fingers and on the barrel of the controller.

The author's experience with a one and a two motor machine of the same type is that, in the case of the latter, where edging the controller is unnecessary except to engage or disengage the raising and lowering gear, the maintenance of the controller (including time, replacements, and general attention) is only a fraction of that necessary with the single-motor machine. More harm seems to be done to the controller in a day's working where constant edging is essential than in a week's straightforward operation.

C.—The use of a single motor for all three motions makes it impossible to obtain that smoothness of working which is the greatest characteristic of the multi-motor machine; while the absence of interconnecting gearing in the latter considerably reduces the stock of spares which dictates of prudence render it advisable to keep. More electrical spares will have to be kept, it is true; but if the electrical gear is standardized so far as is consistent with efficiency, the money lying idle in the provision of such spares will be less than that expended in the provision of a safe stock of mechanical spares for a single-motor machine.

D.—The use of trains of interconnecting gearing between a single motor and the three different motions means that these three motions are rigidly tied together by a gearing the efficient operation of which depends entirely upon the maintenance of a perfect degree of alignment.

The various strains to which the frames of a stoking machine are subjected are too well known by readers of the "JOURNAL" to need repetition here. The natural result of such strains is to cause distortion and the resultant misalignment of whatever gearing is carried by the particular member of the frame that happens to have been subjected to such a strain. Where the motions are tied together in the manner mentioned, the whole of the three motions are bound to be affected by such distortion; and while they will no doubt continue to operate, it is certain that their efficiency will be greatly diminished, and the degree of wear and depreciation will be enormously increased and frequent renewals will be necessary. Such conditions can be best avoided by the provision of an independent drive for each motion, by which means the effects of any strain to which the machine may be subjected will be confined to one only of the individual motions.

VARIOUS MAKERS' PREFERENCES.

So far as the employment of one or more motors is concerned, the following particulars show the practice of the various makers in this respect.

A.—Name of Machine, "DRAKES' STOKING MACHINE." Builders, Messrs. Drakes Limited, of Halifax.

The complete stoking machine manufactured by Messrs. Drakes is a combined charging and discharging machine; the two motions being entirely separate. The charging element or rotor is somewhat similar to the paddle of a steamship, but is divided on the vertical plane into two halves by a centre plate. The coal is fed into the rotor casing above and behind the centre, and is thrown into the retort by the centrifugal motion imparted to it by the paddles or shovels on the rotor, the speed of which can be varied according to the height of the charge which it is desired to place in the retort.

In this machine, as in the De Brouwer, the charging element does not enter the retort. Each of the four motions—charging, discharging, raising-lowering, and travelling—is operated by a separate controller, and is protected by a double pole circuit-breaker and fuses. Very complete arrangements are made to guard against the possibility of being absolutely stuck through the failure of the motors or control gear on the hoisting-lowering, discharging, and travelling motions, by the provision of means whereby these motions can be operated temporarily by hand in case of a mishap. If, for instance, the ram was in the retort at the moment of failure of the discharging motor, it could be wound out by hand; while in the case of the failure of either the travelling or hoisting-lowering motors, the machine could be adjusted by hand to deal with any retort. While the system of electrical protection employed renders these possibilities very remote indeed, the advisability and utility of such arrangements will be obvious. When breakdowns do occur, it is usually at the most awkward moment, and under conditions which are the reverse of ideal; and a machine the motions of which can be quickly manned for temporary hand operation possesses a distinct asset in such a feature.

B.—Name of Machine, "DE BROUWER." Type: (1) Charging. (2) Discharging. (3) Combined stoker. Builders, Messrs. W. J. Jenkins and Co., of Retford.

The famous De Brouwer machines are too well known to members of the gas industry to need much description. The three general types of the "all electric" class built by Messrs. Jenkins are: (1) The charging or projector machine, in which the "D.B." projecting apparatus is carried in a steel frame suspended within a travelling base; (2) the discharging or ram machine, likewise consisting of a travelling base in which is suspended an inner platform on which the ram or pushing element is mounted; and (3) the complete stoker, in which these two previous and separate types are combined on one platform in such a manner that the axis of operation of each apparatus lies in the same horizontal plane, thus enabling the machine to charge or discharge any one retort without altering its vertical adjustment.

In the case of all three types the travelling motor is mounted on the sill plate, and is used to operate both the travelling and the raising-lowering motions. The motor is coupled to a gear-box having at its side a chain drum to which are attached raising chains. The drum is operated by a spring-controlled clutch.

In the case of the projector and combined machines, a separate motor is, of course, used for the projector, and is of the shunt-wound type, having a speed regulation effected by field control of from 750 to 1500 revolutions per minute. The ram motion in both these machines is also served by a separate motor. The equipment is protected in the following manner: (1) The motors by a circuit-breaker. (2) The limits of raising and lowering the inner frame in all three types of machines is ensured by the provision of an automatic switch whose function is to cut off the supply of current to the raising-lowering and travelling motor in case these limits are exceeded. (3) A safety device is provided on the ram controller, the function of which is to automatically bring this controller to the off position upon the approach of the ram to the limits of its stroke, both outward and return.

The following table shows the ratings, types, and speeds of the motors used on the different motions of the three types of machines.

Type of Machine.	Motion.	Type of Motor.	B.H.P.	Speed.
Projector	Charging	Shunt	6	750–1500
Do.	Travelling and hoisting-lowering	Compound	7½	310
Discharging ram	Ram	Compound	11	350
Do.	Travelling and hoisting-lowering	Compound	11	350
Combined stoker	Charging	Shunt	6	750–1500
	Ram	Compound	11	350
	Travelling and hoisting-lowering	Compound	11	350

NOTE.—Each motor is operated by a separate controller.

C.—Name of Machine, "FIDDES-ALDRIDGE SIMULTANEOUS CHARGING-DISCHARGING MACHINE." Type, single motor. Builders, Messrs. Aldridge and Rankin, of Bath.

This machine is of the true "simultaneous" type, inasmuch as the dual operations of charging and discharging a retort are carried out by one stroke of the chain or fire element. The machine provides a striking example of the ingenuity that allows of a dual operation being carried out with the greatest efficiency and at the same time the least degree of mechanical complication. A crane type totally enclosed motor is fitted on the inner frame of the machine, and drives through positive clutches the three motions of charging-discharging, raising-lowering, and travelling. The gearing connecting these three motions is so arranged that when the operation calling for the greatest transmission of power (the charging-discharging motion) is in progress, the efficiency of transmission between the motor coupling and the actual retort element is the same as though a separate motor were employed for this duty; being undiminished by the presence of the gearing of the other motions.

The motor employed is of 13½ B.H.P., 480 R.P.M., one-third load factor, and is protected by a circuit-breaker and fuse box. An automatic device is also fitted to the machine to automatically cut off the current in the event of the charging-discharging chain

being driven either forward into the retort or backward into the machine beyond the limits of safety.

D.—Name of Machine, "FIDDES-ALDRIDGE SIMULTANEOUS CHARGING-DISCHARGING MACHINE." Type, two-motor. Builders, Messrs. Aldridge and Rankin, of Bath.

This machine, which represents Messrs. Aldridge and Rankin's atest practice, follows closely on the lines of their single-motor stoker; the difference consisting in the provision of a separate motor for travelling. The 13½ B.H.P. crane motor, which in the single-motor machine was used for the operation of all three motions, is in the later machine used for charging-discharging and raising-lowering; the latter motion gear, as in the older type of machine, having no effect upon the efficiency of the former, and most important, operation. A series-wound crane motor is mounted on the near sill plate, and drives the travelling axles through a worm-gear box. A general description of this machine will be given in a later portion of this article, as also a series of tests carried out on a machine of this type in the No. 1 retort-house of the Plymouth and Stonehouse Gas Company.

E.—Name of Machine, "GUEST-GIBBONS CHARGING AND DISCHARGING MACHINE." Builders, Messrs. Gibbons Bros., of Dudley.

This machine is of the combined charging-discharging type, pushing out the coke in one movement and charging the retort in three stages. Each movement—hoisting-lowering, travelling, and charging-discharging—is operated by a separate motor; while each motor is controlled by a separate controller, and is protected by an overload automatic circuit-breaker. The motors are of the totally enclosed crane type, and of the following rated outputs: Charging-discharging (20-feet retorts), 15½ B.H.P. Charging-discharging (less than 20-feet retorts), 11 B.H.P. Travelling, 7½ B.H.P. Hoisting-lowering, 7½ B.H.P.

In this machine the travelling and the raising-lowering motor controllers are situated on the near sill plate; their spindles being extended vertically through a sliding operating wheel, which is always at the level of the operator's hand and which moves up and down with the vertical travel of the inner frame.

F.—Name of Machine, "TOOGOOD RETORT-CHARGING MACHINE." Type, Latest. Builders, Messrs. R. Dempster and Sons, of Elland, Yorks.

The outstanding feature of Messrs. Robert Dempster's latest stoking machine is that while the retort charging and discharging elements are quite separate as far as working is concerned, they both lie on the axis of the particular retort being dealt with; and it will be seen that this machine combines the merits of the independent machine with the undeniable advantage, in this respect, of the single-stroke machine. The machine can completely stoke a retort in one setting, or, in the event of a mishap to (say) the discharging gear, the charging element of the machine can continue to perform its duties, or *vice versâ*—a factor of moment, particularly in small works. The stoking operations—namely, charging and discharging—are grouped on one motor mounted on the suspended inner frame of the machine. The travelling and hoisting-lowering motions are performed by a second motor fitted on the main frame of the machine. Each motor has its own controller.

G.—Name of Machine, "WEST'S STOKING MACHINE." Builders, West's Gas Improvement Company, of Manchester.

Two motors are used in the West machine—one for the stoking operations, mounted on the inner suspended frames, and a second motor for the travelling and raising-lowering motious fitted to the main frame of the machine. These two motors are operated by separate controllers.

(To be continued.)

MANCHESTER INSTITUTION AND SULPHATE OF AMMONIA.

THE General Committee of the Manchester District Institution of Gas Engineers, at a recent meeting, had before them the circular-letter from the Board of Agriculture and Fisheries, intimating the suspension of sulphate of ammonia exports, together with copies of letters from ammoniacal liquor contractors to some of the gas undertakings. After full consideration, it was resolved —"That the Council of the Institution of Gas Engineers be respectfully requested to take immediate steps to bring to the notice of the Board of Agriculture and Fisheries and of the Fertilizers' Committee, by deputation, if possible, the serious loss and difficulty which will at once accrue to the many undertakings now disposing of their crude liquor to contractors, by reason of the stoppage of exports and the notification from the contractors that they would only pay on prices they can obtain for such sales as they may be able to effect locally, while at the same time declining to guarantee the clearing of the present stocks of liquor and that to be made; and that they be requested also to take such steps as will enable the undertakings to avoid running these to waste down rivers, canals, or drains."

The resolution was promptly dealt with by the Council of the Institution of Gas Engineers, at whose request the members of the Manchester Institution have been asked by their Hon. Secretary (Mr. G. S. Frith, of Runcorn) to advise him if they are affected in any of the following ways, so that concrete cases may be reported to the Institution of Gas Engineers, for placing before the Board of Agriculture and Fisheries:—

1.—Where contractors have refused to remove the ammoniacal liquor from gas-works in consequence of the Government's action in suspending licences for the export of sulphate of ammonia.
2.—Where storage tanks have overflowed, and the ammoniacal liquor has been run to waste into drains, rivers, or lakes, in consequence of the failures of contractors to remove from works.
3.—Where sulphate of ammonia manufacturers have been unable to obtain supplies of acid, and the ammoniacal liquor has been run to waste.
4.—Copies of letters from contractors should also be forwarded when stating their case.

PHOTOMETERS DEPENDING ON PHYSICAL AND CHEMICAL METHODS.

THE members of the Illuminating Engineering Society, with Mr. F. W. Goodenough in the chair, devoted last Tuesday evening to a discussion of future possibilities in the design of instruments for measuring illumination; special reference being made to photometers depending on physical and chemical methods. In preparation for the debate, a list of questions had been circulated; but sufficient for our purpose is a reference to two of them. One was as to what methods could be suggested for making illumination photometers of the ordinary type—those involving the use of a comparison source of light—more convenient for use by the general public. The other, and more important one, was as to what are the prospects of making a satisfactory instrument depending on the following physical or chemical methods: (*a*) The use of selenium or other photo-electric cells; (*b*) the use of thermopiles, or other instruments, for measuring radiation with or without a suitable solution or screen for absorbing the non-visible rays; (*c*) the difference in expansion of two metallic elements—one polished so as to reflect a maximum of visible light, the other coated with an absorbent matt-black material, but otherwise similar; and (*d*) the use of photographic methods such as the darkening of light-sensitive paper. Letters were read from Mr. A. P. Trotter, Mr. Haydn T. Harrison, Professor E. W. Marchant, Mr. P. J. Waldram, Professor Fery, and Dr. H. E. Ives (of the Physical Laboratory of the United Gas Improvement Company). Those who took part in the discussion were Mr. J. S. Dow, Mr. A. Cunnington, Mr. J. M. Frezise, Mr. J. W. T. Walsh (National Physical Laboratory), Professor Addenbrooke, Mr. W. R. Cooper, and the Chairman, and Mr. Leon Gaster wound up the discussion. The best part of two hours was spent over the questions. We are not going to report all that was said and read; but will assemble the principal points on the main subjects.

EXISTING ILLUMINATION PHOTOMETERS.

Regarding the question of whether improvements can be effected in present illumination photometers of the ordinary type, Mr. Trotter does not think that the general public should be encouraged to amuse themselves with such instruments. Some experience is necessary; and intelligent precautions must be taken to secure useful results. In his opinion, instruments of the "Lumeter" and the "Luxometer" types, having wide ranges of adjustment, in addition to dark glasses, are bound to supersede older instruments. On the other hand, Mr. Harrison does not appear to consider that photometers for the general public is outside the scope of practical politics, as he suggests that such photometers should not embody the use of an eye-piece; seeing that few people can accustom themselves to work with one eye as correctly as they can do when taking a general view of a screen with both eyes. Professor Marchant considers that the Trotter illumination meter and the "Lumeter" are both quite convenient and simple. The practical difficulty that he finds is in keeping the battery in good order. When, as often happens, the instrument is not used for comparatively long periods, it is always necessary to employ some form of volt meter; and he suggested that this might be fitted to the instrument, together with some curve tables by which the readings of the instrument could be corrected for variations in lamp voltage. Mr. Dow stated that the point had been considered in connection with illumination photometers. It struck him, however, that if a volt meter is used it must be a very good one; otherwise it would be very misleading. Professor Marchant suggested additional structural details (as did Mr. Cunnington later) for improving the usefulness of this form of instrument; one suggestion being that it might be possible to devise some mechanical device whereby the readings could be automatically corrected for variations in battery pressure. For accurate comparisons of illumination, the same contributor has found nothing better than the Lummer-Brodhun photometer. Even with lights of different colours, he has found that, with practice, it gives excellent results—results far better than he has been able to obtain with a "Flicker" photometer. Mr. Cunnington thinks in some quarters there is a tendency to exaggerate the difficulties with illumination photometers; but with practice a lot of the difficulties disappear. He also described an illumination gauge which he has designed for making

rapid approximately comparative tests—say, over an area, or of different lamps under similar circumstances.

Physical or Chemical Methods.—Photo-Electric Cells.

There seems to be a fair balance of opinion that photometers of the physical type will be developed to such an extent as to do away with the inaccuracy introduced by the human eye in ordinary photometric work. Those who have gone farthest in the matter of investigation and experiment are those who are the most confident of ultimate success in this direction. For instance, Professor Fery says: "I am convinced that the photometer of the future will be of a type independent of the personal peculiarities of the observer; for the invariable tendency in physical matters is to devise methods of measurement which are independent of physiological processes." The workers in this direction are several; and Dr. Ives is one of the foremost, and one of the most confident of attaining practical success. As Mr. Walsh stated, physical photometry was originally developed in Germany; but during recent times great strides have been made in the United States. Roughly, physical photometers are divided into two main divisions—those which employ photo-electric phenomena, and those depending upon the measurement of radiation. It is Mr. Walsh's view that comparison of two sources of light is all that is in any way practicable at present; and though it would be a distinct advance to be able to supplant the human eye by some physical apparatus, yet, he thinks, it would be a still greater boon if some means could be found of actually measuring illumination without the necessity of constant reference to some standard of comparison. In his opinion, advance along these lines appears to be very promising in the case of those physical photometers in which the radiation of a source is measured by some instrument working generally on the principle of the thermopile. In his communication, Dr. Ives mentioned that a most serious objection to the use of the photo-electric cell is the lack of direct or uniform proportionality between the illumination and the current; but in his laboratory the conditions under which this important relationship is strictly rectilinear have been established. A new design of photo-electric cell has been worked out, in which the current does not vary in unexpected ways from the illumination; and with this improvement, Dr. Ives says, the photo-electric cell is a wonderfully sensitive instrument for use where questions arise as to colour differences. However, there still remains the disadvantage that apparently no two photo-electric cells have the same wave-length sensibility curve. Should it be possible to make cells of uniform wave-length sensibility, so that luminosity curve sensibility could be produced by a proper absorbing medium, the photo-electric cell would probably be the most sensitive and convenient of all forms of physical photometers. With experience with selenium, Mr. Harrison finds that the greatest care has to be exercised in the preparation and maintenance of a selenium cell. There is, moreover, a time-lag which is often a serious disadvantage. Professor Marchant (who, by the way, is inclined to think that an instrument depending for a reading on extinction of vision has very small prospect of accuracy) referred to an instrument designed by Mr. Turner, the Electrical Engineer at Hoylake, which depended for its working on a selenium cell. Its object was to switch on a street-lamp when the illumination fell below a certain limit determined by the resistence of the selenium cell. Such a piece of apparatus he thinks has great possibilities. Professor Addenbrooke spoke of the impurities of selenium, and he does not see much chance of using selenium cells as a standard, unless comparison can be made with some other cells, and unless, too, they are used in a short time. It is also Mr. Cooper's view that selenium is not a very satisfactory substance with which to deal. It has, he says, been proved that, if selenium is taken and purified as far as possible, the result is better than if there were not any impurities at all. Mr. Gaster recollects that when in Berlin, with Professor Ruhmer (who was connected with the manufacture of selenium), he told him that he did make the pure material.

Measurement of the Radiation of a Light Source.

In his reference to physical photometers working on the principle of the measurement of the radiation of a source, Mr. Walsh alluded to the instrument developed by Dr. Ives and Mr. E. F. Kingsbury. They use a thermopile consisting of eighteen junctions of bismuth and silver deflecting a galvanometer of the d'Arsonval type. It is, of course, necessary to ensure that the sensitivity of the thermopile at various wave lengths shall exactly correspond with that of the average eye; and for this purpose a colour filter is used, consisting of a solution of certain chemical salts in water. It is found that with this apparatus candle powers as low as eight can be measured to an accuracy of at least 1 per cent. The chief trouble appears to be the drift of the thermopile galvanometer system, which may amount to as much as several per cent. during the time taken for the deflection and the return to zero. Mr. Walsh referred to this as a fascinating method of photometry—"a method which, I think, it will be generally agreed, is rapidly passing through the experimental stage, and which in a short time will force its way into photometric laboratories all over the world." Confirmation of this opinion is gathered from the tenour of Dr. Ives' communication. He states that the thermopile physical photometer is working admirably in practice. Its only drawback is that its sensibility is so low that it can only be looked upon as a laboratory instrument. Since, however, it is now being rather generally agreed that all photometric work involving colour differences should be done in a standardizing laboratory, this objection is not at all a serious one. In connection with this question of sensibility, it is interesting to learn that Dr. Ives is at present very much interested in the possibility of increasing the effective sensibility of all kinds of radiation measuring instruments, by some sort of current amplification, along the lines of those which have recently been developed for wireless telegraphy and telephony. The possibility is an attractive one, and is receiving attention. Photometrical methods that are subject to physiological impressions do not appeal to Professor Fery, owing to the measurements depending on the visual peculiarities of observers. In his view, apparatus for measuring the total energy radiated by an incandescent body also appears to be the method most worthy of consideration. The response of a bolometer depends on the temperature of the incandescent source. The method has a tendency to favour sources of low temperature—just the opposite to the tendency of the photographic methods. Nevertheless, in Professor Fery's opinion, it is possible to get over this difficulty by the use of suitable screens. In 1908, he employed with success a radio-micrometer, combined with a screen composed of a solution of copper acetate, in order to provide a direct reading photometer giving the same sensitiveness throughout the spectrum as the normal eye. More recently he has used cells of suitable absorbing mixtures with a thermopile. Mr. Trotter is inclined to think that a differential bolometer depending on the resistance of a fine wire is the best method of relying on direct physical measurements; but it entails the use of expensive apparatus. While the employment of thermopiles or other instruments for measuring heat strikes Mr. Harrison as being novel, he cannot imagine that a true illumination value could be measured by this means. Opposed to this is all the other testimony previously quoted.

Miscellaneous Points.

Among incidental matters Mr. Frezise described screens which he has developed—a good one being of clear glass with a thin surface of opal, by which he gets equality of illumination right up to the edge of the screen. Attention was drawn by Mr. Walsh to a neutral form of filter for photometrical use which he has designed. It consists of a piece of clear glass, coated with an opaque dead-black varnish. Thin lines are then scratched through the varnish, thus baring the glass, and presenting a transmitting area which might bear any desired ratio to the opaque non-transmitting area. If these lines are carefully ruled, the transmitting coefficient will be even all over. A rough specimen which Mr. Walsh constructed gives a surprisingly even field when used on the front of a Lummer-Brodhun photometer head. A similar device which has proved very useful just lately in the reduction of very green illuminations is the use of successive thicknesses of black veiling.

Accuracy of Illumination Readings.

Towards the end of the discussion, the Chairman (Mr. Goodenough) remarked upon the necessity of having some reliable form or forms of portable photometers, if low illumination readings are to be introduced as determining factors regarding the performance or non-performance of street illumination contracts, and the compliance or non-compliance with statutory requirements in factories and workshops. He does not feel sufficiently sure that the portable photometers on the market can be relied upon with such a degree of certainty within a small or reasonable margin of error as would provide the basis for a penalty clause. At any rate, he does not feel it himself; and he does not think many of those who are acquainted with the subject of illumination feel any certainty either. What is wanted is some assurance that results are being obtained by means of some portable or easily handled instrument with approximate closeness to laboratory tests. He expressed pleasure at learning from Mr. Walsh that the National Physical Laboratory had, before the outbreak of war, began research in the direction of photometers depending upon physical and chemical methods. Obviously, the ideal is a physical and not a physiological determination of illumination, so that there can be no question of dispute as to the introduction of human error. Mr. Gaster thought the point an interesting one as to the degree of accuracy one is entitled to secure from illumination photometers. It is, in his opinion, absurd to expect portable apparatus to get nearer than 20 per cent. to absolute accuracy; to get within 25 per cent. should give satisfaction. A photometer for scientific investigation in repect of penalties ought, of course, to be a most accurate apparatus; but for factories an accuracy within 25 per cent. would be quite good enough.

Nitrate Production in Germany.—Information concerning the manufacture of nitrogenous fertilizers, the productive capacity of the Imperial works which have been established, and the organization formed for the distribution of the products, has been given by Dr. Helferich, Secretary of State to the Imperial Treasury, at a meeting in the Prussian Lower Chamber. The Secretary added that in the fixing of the sale prices, the Imperial works would have to take into consideration the question of the conditions of remunerativeness of private industry. On the other hand, a German newspaper claims that the works already in operation are producing at the rate of 300,000 tons of nitrate per annum in the form of sulphate of ammonia; so that not only are the requirements of agriculture fully covered, but sufficient quantities also remain available for the manufacture of explosives.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Forty-Sixth Annual Meeting.

THE Forty-Sixth Annual Meeting of the Institution was held at the Grand Hotel, Manchester, last Saturday—the retiring President, Mr. J. G. NEWBIGGING, M.Inst.C.E., the Chief Engineer to the Manchester Corporation Gas Department, being well supported by the presence of Mr. Edward A. Harman, of Huddersfield, the President-Elect, Mr. W. Whatmough, of Heywood, and Mr. J. P. Leather, of Burnley, Vice-Presidents, Mr. Samuel Glover, M.Inst.C.E., of St. Helens, Mr. G. S. Frith, of Runcorn, the Hon. Secretary, and other officials.

The PRESIDENT, in opening the proceedings, said that, as there was a heavy *agenda* to get through, it was proposed to take the minutes of the last meeting, on Oct. 30, as read.

This course was agreed to.

LETTERS OF REGRET.

The HON. SECRETARY announced that a number of letters and telegrams had been received expressing regret for non-attendance, including Mr. John Bond, of Southport, the immediate Past-President of the Institution of Gas Engineers, Mr. A. Morton Fyffe, M.Inst.C.E., of Blackburn, Mr. Alderman W. Kay, J.P., the Chairman of the Manchester Corporation Gas Department, and others.

MESSAGES OF CONDOLENCE.

The HON. SECRETARY, referring to the messages of condolence ordered at the last meeting to be sent to the families of Mr. Thomas Bower, of West Hartlepool, and Professor Vivian B. Lewes, said he had received acknowledgments from Mrs. and Miss Bower and from Mrs. Vivian B. Lewes. He also reported that at a meeting of the Committee of the Manchester Institution about a fortnight ago a vote of condolence was forwarded to Mr. Thomas Glover, of Norwich, on the loss of his son, who was recently killed in action. He had received a letter from Mr. Glover acknowledging his thanks and deep sense of appreciation of the brotherly action of the members in sending the message during this period of trial. "Let us all try to be worthy of our heroes" was the concluding sentence of Mr. Glover's letter.

INTRODUCTION OF NEW MEMBERS.

The PRESIDENT introduced the following new members to the meeting: Messrs. Samuel Carter, of Garston, D. H. Davies, of Nantwich, Edward Hargreaves, of St. Annes-on-the-Sea, G. W. Houston, of Crewe, and Herbert Wrigley, of Oldham.

ELECTION OF HONORARY MEMBERS.

The PRESIDENT said that perhaps members would have noticed a new feature in the "Manual" for 1916. Under the powers given to the Committee by Rule 1 they had commenced the election of honorary members; and the first two to be elected were Mr. William Duff, of Morecambe, and Mr. Charles Eastwood, formerly of Batley but now of Southport, who was originally elected a member of the Institution in 1879, and was President in 1883.

THE ANNUAL REPORT.

The PRESIDENT said he had much pleasure in moving the adoption of the annual report of the Committee for the twelve months ended Jan. 31 last, which (in addition to recording the proceedings during the past year) contained the following remarks:

The Committee have much pleasure in reporting that the Institution continues in a most prosperous condition. The membership roll remains the same as last year—200. There have been three resignations; five names have been removed under rule 15; and the Committee record with feelings of deep regret the death of their highly-esteemed colleague, Mr. Edward Allen, M.Inst.C.E. (of Liverpool), whose irreparable loss will be keenly felt, not only by the members of this District Institution, but by the members of the gas profession generally throughout the country. They also regret to record the death of Mr. T. Bower, M.Inst.C.E. (of West Hartlepool), an old and respected member of this District Institution, who was elected in 1878, and Mr. T. Oswald (of Bolsover).

The Manchester and District Junior Gas Association having decided to discontinue the Manchester University lectures during the period of the war, the usual grant of £15 has not been made. The development of the classes for gas-fitters has been seriously retarded owing to a very large percentage of men having joined the Army. The Committee have considered and recommended 31 applications for certificates to be granted by the Institution of Gas Engineers to gas-fitters over 35 years of age. The question of placing gas-works under the operations of the Munitions Act has been considered by the Committee; and a resolution was forwarded to the Institution of Gas Engineers on the subject.

The annual reports of the Lancashire and the Yorkshire Commercial Sections have again been distributed to the members. The splendid work performed by these District Sections during the past twelve months—undoubtedly the most trying period ever experienced in the annals of the gas industry—cannot be over-estimated. Mr. W. Whatmough (of Heywood) was again unanimously elected the representative of this District Institution on the Council of the Institution of Gas Engineers. Mr. S. E. Halliwell (of Littleborough) and Mr. F. H. Pickles (of Kildwick) were re-appointed the representatives on the Council of the Lancashire and Yorkshire Junior Associations respectively. The finances of the Institution are in a very satisfactory condition, the credit balance being £31 8s. 11d.

(Signed) J. G. NEWBIGGING, *President*.
G. S. FRITH, *Hon. Secretary*.

Mr. E. H. HUDSON (Normanton) seconded the adoption of the report, and the members agreed to it.

STATEMENT OF ACCOUNTS.

On the motion of the Hon. Auditor, Mr. CHARLES POTTS (Hyde), seconded by Mr. WILLIAM HILL (Stalybridge), the statement of accounts for the year ended Jan. 31, 1916, was approved, showing a balance in the hands of Mr. James Braddock (Radcliffe), the Hon. Treasurer, of £31 8s. 11d., as compared with £24 15s. 7d. twelve months ago.

SUBSCRIPTIONS OF SOLDIER-MEMBERS.

The PRESIDENT said the Committee had decided to waive the subscriptions of members serving with the Forces. He was sure this course would meet with the approbation of members generally. ["Hear, hear."]

REPORTS OF COMMERCIAL SECTIONS.

The PRESIDENT said he thought these reports should be taken as read. They were very valuable documents, and the two sections were to be congratulated on the good work they were doing. They were, he was sure, serving a very useful purpose, and particularly at the present time.

Mr. S. MEUNIER (Stockport), the Chairman of the Lancashire Commercial Section, rising at the invitation of the President, said he had much pleasure in moving the adoption of the reports. He did not think he need waste any time in enlarging on the work of the Commercial Sections, as the report, so ably drawn up by their friend Mr. S. E. Halliwell, of Littleborough, spoke for itself. There was no doubt about it that they were doing extremely useful work, and time had shown the great necessity for these Commercial Sections. Questions they were now dealing with—brought about by the war and by Government action—such as short supplies of coal, decrease in number of licences for the export of sulphate of ammonia, creosote, oils, &c., had shown that they were up-against some very stiff propositions, and it behoved all of them, not only in Lancashire and Yorkshire, but in all parts of the country (and he hoped also the British Commercial Gas Association), to put their shoulders to the wheel and see whether they could not manage to improve their positions.

Mr. F. H. PICKLES (Kildwick) said that it afforded him much pleasure to second the adoption of the reports, and to pay tribute to the work of the Commercial Sections, particularly at the present time. He did not think there was ever a time when there was more need for the work now being done to be done. The monthly meetings of the sections were very valuable to all of them—indeed, he sometimes felt that they could do with meeting oftener than once a month. They could never go back to the old way of waiting for the ordinary meetings of the members of the Institution in order to discuss these important matters—to do so would, he was convinced, be a mistake. It was a great advantage to be able to meet once a month, and to discuss matters as they arose.

The reports were then adopted without further comment.

RECOMMENDATIONS OF THE COMMITTEE.

Mr. J. C. BELTON (Chester) proposed, and Mr. F. H. PICKLES (Kildwick) seconded, the appointment of Mr. W. Whatmough (Heywood) as Representative of the Manchester District Institution on the Council of the Institution of Gas Engineers for the year 1916-17.

Mr. S. MEUNIER moved, and Mr. TIM. DUXBURY (Oldham) seconded, that the sum of Ten Guineas be granted to the Benevolent Fund of the Institution of Gas Engineers.

A TRIBUTE TO THE "B.C.G.A."

Mr. S. TAGG (Preston) proposed, and Mr. ROBERT WATSON (Doncaster) seconded, a further recommendation of the Committee that £5 5s. be granted to the British Commercial Gas Association.

Mr. WATSON desired, at the same time, as a member of the Executive Committee of the British Commercial Gas Association, to acknowledge with thanks the very graceful references in both the Lancashire and Yorkshire Commercial Section reports of the work done by the Association. He assured them that the "B.C.G.A." much appreciated what the Manchester Institution did for them, and the kind acknowledgments he had alluded

to would spur them on to even better efforts. He really did hope that this tribute to their work would prove an incentive to those undertakings that were not as yet members of the Association, and that they would come forward and help them in view of the good work being done.

British Red Cross Society.

Mr. Kendrick said he had great pleasure in moving that the sum of Ten Guineas be granted to the British Red Cross Society. This was in lieu of the ten guineas devoted last year to the Prince of Wales Relief Fund.

Mr. C. Potts seconded; and the vote was agreed to unanimously.

Induction of the New President.

The President said the time had now come for him to perform the final duty of his office, and that was to induct Mr. Harman in the presidential chair for the ensuing twelve months. He was sure it gave great satisfaction to the Committee, as he was sure it had to all the members, to see Mr. Harman in this position. He richly deserved the honour conferred upon him. Mr. Harman during his membership had contributed various papers and had taken an active part in the debates, and in this way had contributed in no small measure to the progress and success of the Manchester Institution. He was confident they all wished him a very pleasant year of office. He could only say that they would all do their best to make it a conspicuous success.

A Loyal Key-Note in the "New Year."

Mr. Harman then took the chair amid the cordial plaudits of his colleagues, and asked that he might, first of all, be permitted to say that as they were met together upon matters concerning the public interest, and also of interest to the Nation as a whole, and as the Nation was passing through the most critical period in its history, he proposed to ask the members to rise and join in singing the National Anthem—to show their patriotism at the commencement of the "New Year" of the Manchester District Institution.

The members having joined heartily in the singing,

The President said the first business he had to undertake was to propose a hearty vote of thanks to their retiring President, Mr. Newbigging, for his splendid services during the year. He (the President) was unaware when he entered the room that this would be his privilege, for he certainly esteemed it as such. The members all knew how deeply the Institution was indebted to him for his splendid work of the last twelve months—he believed the resolution applied to the last twelve months only, although Mr. Newbigging had held the presidency two years—and his services had been invaluable. He had rendered every kind of assistance it was possible for a President to render, not only in his valuable addresses and in persuading his Committee to allow them to view his magnificent works, which, as they knew, were masterpieces of engineering skill, but he had been in personal touch with everything appertaining to the interests of the Institution. He was sure he voiced the feelings of the members in proposing a hearty vote of thanks to him for his services.

Mr. W. Whatmough said he had much pleasure in seconding the vote of thanks. Mr. Newbigging throughout his year of office had shown great business aptitude and knowledge of the requirements of the industry. They had had a very happy year indeed, especially in the Committee meetings.

Mr. Newbigging's Thanks.

Mr. Newbigging said he thanked the proposer and seconder for the kind words they had used in proposing the vote of thanks to him for the small services he had been able to render during the two years he had held office as President. He had been fortunate in being ably supported by his Chairman, Alderman Kay, J.P. (whom he regretted could not be with them that afternoon owing to a previous engagement), and his Committee. He particularly wished to thank the Officers and the Committee of the Institution for the kind help and consideration they had always given to him, and, as Mr. Whatmough had said, they had had a very happy time together. He particularly desired to mention the services of Mr. Frith, their esteemed Hon. Secretary. Mr. Frith had done all the drudgery, and he had simply had to look on. The Hon. Secretary had done excellent work; and he was much indebted to him for relieving him in many respects. He was sure he would look with very great pleasure on the two years of his presidency, and again begged to thank them for their kindness.

The Presidential Address.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—Let me first of all tender my sincere thanks for the honour you have conferred upon me by electing me President of the Institution. No one recognizes more fully than I do my limitations, as a Consulting Engineer only, for the duties involved; and therefore at the outset I would claim the indulgence that you are, I am confident, prepared most generously to concede, and upon which I rely.

The War—and After.

It will be appropriate to remark upon the difficult times in which we are living; and indeed it would be impossible not to do so. Gas engineers, in common with everybody else, have never before had such a severe time of stress and strain. Well has it been said that civilization appears to be bankrupt. The world has been astounded by the enormous proportions of the present war. More than one-half of humanity is engaged in it. Millions of men are in arms against each other. So long as the motto, "Might is Right," is adopted by individuals, there can be no cure. Only let it be reversed, then all will be well. Apart from the external warfare—distracting as that is—there have been (interdependent upon the war) difficult problems to solve inside the works, which are so well understood by all that it is not necessary to dwell upon them.

There are not wanting people to tell us what will happen when the war is over—a consummation devoutly to be wished. But their prophecies may be discarded. One thing is certain. Gas-works will still be required; and it is the difficult times through which we are now passing which should qualify for the exceptional opportunities of the future. It is equally certain that when the war is over, labour difficulties will have to be met and overcome. To provide for this, hand labour must be replaced by machinery, whenever and wherever practicable—not merely, if at all, for the sake of financial economy, as for the economy of physical force. One is bound to recognize that this is being prodigally wasted all over Europe and elsewhere; and therefore in time to come the man who will be able to pull a lever or turn a valve-wheel will become increasingly valuable. In many ways, organization may be improved, which will have desirable results in the general working of all undertakings.

Engineering and Trade.

With reference to gas engineering as a whole, much might and ought possibly to be said; but it is not my intention to attempt the impossible and to range over the entire ground covered by the term. Included in it may be, directly and indirectly, said to be the whole of civil and general engineering, together with architecture, chemistry, and many other subjects. The definition of the Institution of Civil Engineers to my mind exactly indicates also the province of gas engineering. It is as follows: "A Society established for the general advancement of mechanical science, and more particularly for promoting the acquisition of that species of knowledge which constitutes the profession of a civil engineer, being the art of directing the great sources of power in Nature for the use and convenience of man." Adopting this definition, then, gas engineers should be in the front rank of professional men. Their work includes numerous branches of science and (if I dare say so) commerce, too. They are inseparable; and yet there are those who, for their own reasons, desire to keep science and commerce as far asunder as the poles.

The vexed subject of trade is one which should not be lightly ignored. While it is easy for eminent engineers to scorn such a word, it is nevertheless a fact that many, if not all, are directly and indirectly intimately associated with it. There have been those who have rigorously deprecated any connection with trade. This attitude has only been superficial; for, as already indicated, there has been a strong affinity existing, unseen by the public eye. A wiser generation will realize their complete association.

Evolution of Gas Engineering.

Gas engineering has been a matter of evolution. Take, for instance, the early gasholders. Look at the rectangular ones recorded by Accum and others in the year 1815. A noteworthy gasholder is mentioned at the Brick Lane station of the Chartered Gas Company as having a capacity of 22,000 cubic feet; while another belonging to the same Company was equal to 15,928 cubic feet, and at Westminster the "gasometer" was equal in capacity to 14,808 cubic feet. The illustrations in Accum's book have considerable interest in them. Compare these with to-day's colossal structures, capable of storing millions of cubic feet, and the development will at once be apparent. In the year 1815 Accum states: "I am informed by Mr. Clegg, the Engineer of the Chartered Gas Company, that the total length of pipes laid down as mains, in the streets of London amounts already to nearly fifteen miles." In the last published returns available for the three London Companies, the length of mains is recorded as being more than 4000 miles; while an additional 2000 miles is accredited to eight London Suburban Companies.

The early designers are to be admired for their pioneer work. The man who made the first wheel little dreamt of the subsequent uses to which the principle would be applied; or even the man who designed the first wheel-barrow. These men discovered certain broad principles which are yet only in their infancy. The developments of the past hundred years have been amazing; but who shall predict what the next century has in store for gas undertakings?

Primarily for gas engineers are the questions as to the most desirable form of carbonization of coal, the design of regenerative furnaces and apparatus therefor, all kinds of purification plant, and the intricate and complicated questions of the best machinery available and suitable for the transport of all kinds of material. The working and making the best out of the residuals are of immense importance—one should say of national importance. It will be remarked that these are largely questions which each engineer must deal with according to special local and other considerations.

It is not unusual to hear the statement that a small gas-works is the unit for a large one. This is certainly not the case. Dealing with a few tons of material per day is not like dealing with thou-

sands. Neither is the business of controlling and directing a few men comparable with that of hundreds. Take the task of supervision alone. In many a small works, a glance round them is often all that is required to ascertain that everything is in order, or otherwise; whereas in a works covering many acres, several hours are necessary.

EXTENSION OF WORKS.

In all works alike, the proportions of the plant have to be considered and recorded; and, where a deficiency is apparent, the plant must be increased as opportunity arises. A plant-book, showing the sizes and capacity of all apparatus, is an indispensable item in all well-managed works. In planning a new works, it is now the practice to arrange for complete sections, so as to add additional units as required. But when increasing an antiquated works, the conditions are totally different. The ground site, which may be ample in area, may not have the shape or possibilities available for this idea. Take as an illustration where a new retort-house may have to be erected in an isolated position, and the connections to the existing plant have to be carefully rearranged. It is an easy matter to insist that the whole of the works wants pulling up by the roots, so that an economical and efficient plant may be installed; and incidentally calling in question the ability of the designer—thereby creating considerable local inquiry as to "why all this was not done before?" This method does not require the maximum ability. One readily understands, by a large expenditure of money—especially if borrowed upon easy terms repayable over a long term of years—an immense economy in manufacture could often be effected. One knows of old loans, extending for fifty, sixty, eighty, and even a hundred years, where the sinking-fund is consequently trifling. It is interesting to refer to the blue-books, with regard to the present practice of the Local Government Board. In the year 1903 the periods for the repayment of loans sanctioned by them, relating to gas undertakings, were fixed, and the following particulars, relative to gas-works, are recorded:—

THIRTY YEARS: Gasholders, tanks, hydraulic mains, condensers, scrubbers, mains, governors, coke-stage, and tar-well.

TWENTY YEARS: Purifiers (boxes and covers), exhausters, station meters, and washers.

FIFTEEN YEARS: Sulphate plant, benches, photometer, and testing appliances.

TEN YEARS.—Stoking machinery, meters, cooking-stoves (for hire), lamp and columns, and working capital.

FIVE YEARS.—Incandescent gas burners and fittings.

TWO YEARS.—Retorts.

In the same paper an example is given of an equated period for the repayment of a loan for gas-works purposes. It is as follows:

Description of Work.	Estimated Cost.		Usual Term of Years Allowed for Repayment.		
Buildings	£2500	×	30	..	£75,000
Mains	1245	×	30	..	37,350
Gasholders . . .	1500	×	30	..	45,000
Condensers . . .	530	×	30	..	15,900
Purifiers	1000	×	20	..	20,000
Benches	1200	×	15	..	18,000
Meters	530	×	10	..	5,300
Retorts.	600	×	2	..	1,200
	£9105				£217,750

Then $\frac{217,750}{9105} = 23{\cdot}9$ years, the period for the repayment of the total loan; and 24 years would be allowed.

It will be noticed that the old long-term loans have died out, and rightly so.

It is the rearrangement of the existing conditions which brings out the best ability in the engineer. Here, too, permit me to say that the best advice to be obtained upon any reconstruction scheme is from the engineer upon the ground, and to whom full support and consideration should be granted. Too often new works are undertaken and erected, when the advice of the resident engineer is discounted by the authorities. Later, possibly when the work is completed, they sometimes allow the very one who ought to work the plant to the best advantage to take another appointment rather than increase his remuneration commensurately with his increased responsibilities. It is a simple aphorism that the truest economy is a well-paid servant. This elementary principle even to-day requires to be emphasized, especially so where chief officials are concerned, whose remuneration is not determined by any Society or Union. On the contrary, too often the cheapest salaried official is sought, even where the workmen's wages of the district are the highest. Little consideration is given to the position the engineer has to maintain in the district where he resides.

SELECTION OF PLANT.

Is sufficient consideration given to the subject of selection? One sees plant installed which has not been thoroughly examined. As a general rule, engineers should cultivate the power for selection rather than of designing. The power of being able to determine from many designs which is the best, is one well-nigh amounting to a faculty. It is not the new thing which is always the best. On the other hand, it does not do to be captious and cynical concerning a new idea. Experience and careful thought can accomplish wonders. True it is that some (but only a few) can decide—almost by intuition it would seem—which is the best of many designs. But the majority have not the power. The ordinary plodder has to accomplish the end by steadier, and sometimes by more reliable, means. New ideas are not so much wanted at the moment as the development of old ones. A contribution to, or improvement of, an old design may be as important as a complete new one, while it is quite possible that a valuable invention will be discovered therefrom.

PLEA FOR BEAUTY IN DESIGN.

In a utilitarian age, may one be permitted to enter a plea for this? Why should architectural and engineering structures be hideous, when a few extra pounds would be well spent in decoration? There are to be found gas-works magnificently designed; but can it be truthfully asserted that the majority are? I should like to refer the members to John Ruskin upon such a subject.

STATUS OF THE GAS ENGINEER.

I am fully convinced that this is a most important matter. For inexplicable reasons, it has been allowed to pass unnoticed. A glance at any local directory will confirm this. In even large cities and towns, a few gas-fitters, plumbers, and gas-appliance makers may be found under the classification of gas engineers, while the chief responsible officials of the gas undertaking are absent. I do not want to make invidious comparisons beyond saying that gas engineers are worse represented in local directories than any other profession, trade, or calling. The gas engineer is brought into touch, generally speaking, with every householder resident in the area of supply of the undertaking, and is probably as well known by the inhabitants as any public official. Of course, the directory notice is not of itself consequential; but it is an indication. Professionally, the gas engineer is largely isolated; and it is the particular function of such institutions as the district ones, to foster a bond of friendship and union. At the same time, the *esprit de corps* can be considerably strengthened by a cordial appreciation of each other's work and responsibilities. One engineer is especially good at one thing, another equally expert at another.

The comparison of manufacturing returns is perhaps largely responsible for a spirit of undue rivalry. These returns are of little value, and are often entirely misleading—apart from local and other considerations. For instance, it is outside all fairness to compare local authorities with companies' undertakings. The former are practically free from outside control and testing restrictions, whereas the latter are vigilantly and often unscrupulously molested. On the other hand, the engineer of a company invariably enjoys greater freedom of action than one employed by a local authority. The make or sale of gas per ton of coal is often quoted, with little knowledge of the coal purchased; and this is frequently outside the control of the engineer. A poor local coal may be advantageously used, but showing an insignificant make of gas per ton. Yet the sale of gas per ton is often flaunted as though it were the only item to be considered. The scattered area of supply is a fruitful source of "unaccounted-for" gas. Unaccounted-for it is true, but not necessarily due to leakage. Some works correct to 60° Fahr., 50° Fahr., and lower; while others are content to take the gas at the temperature of the station-meter. Consider the reduction in volume of gas measured (say) at 70° Fahr. at the meter, and on a winter's day, when the consumption is at its maximum, at a distance of three to six miles from the works, when transmitted through cold mains and service pipes over open passages into a cellar having a temperature below freezing point. Such returns are often quoted to the detriment of one undertaking, and the superiority of another. The sooner these comparative statements are only used or quoted with reasonable and equitable explanations, the better for the status of the gas engineer and the right feeling for each other which should pervade all the members.

NATIONAL GAS INSTITUTE.

Following upon the status of the engineer is the ever-recurring question of the provision of a central home in London, capable of the promotion of useful work as well as affording evidence of the importance of the gas engineering profession and its allied industries. For the Institution of Gas Engineers in London a couple of hired rooms is to-day considered sufficient for all purposes. Should a Sub-Committee be called, a curtain may be drawn across a portion of the room to provide for its requirements. Is such an arrangement worthy of the wealthy gas undertakings of the United Kingdom? Without for a moment reflecting upon the excellent work done by the able Secretary (Mr. Walter Dunn) and his assistants, it is manifestly impossible, under such paltry conditions, to efficiently negotiate the work which should be undertaken. It has been frequently urged, and not too strongly, that nearly every other profession and trade has its central organization, properly housed and equipped. Not until a national gas institute, worthy of the name, is provided, will the disgrace and discredit to gas undertakings as a whole be abolished. That the establishment of such an Institute remains in a state of suspended animation owing to the war, is appreciated by us all; but there are not wanting seers who believe that some day it will be an accomplished fact. Foremost among these is the immediate Past-President of the Institution of Gas Engineers (Mr. John Bond) who by his generosity has given the project a fresh impetus.

TOLUOL.

The subject of the moment is the production of toluol for war

purposes; and there are various suggestions for increasing the yield of this. For instance, there is Rollason's method of mixing, the coal with a small percentage of unburnt limestone. This process appears to be based on the idea of generating a gas in the retort at the same time the coal gas is being made, in order to sweep out the gas rich in hydrocarbon vapours, which would be evolved at the beginning of the charging time—probably during the first hour or so after the charge has been put into the retort. There seems to be some doubt as to the advantages obtainable from the method. My own opinion is that it is not all that is desired. What is required is a gas already formed that can be turned on at the lid of a through retort as soon as it is closed, so as to sweep out the hydrocarbon vapours as soon as they are produced and at their maximum. There is nothing new in this idea—indeed, it was mentioned at one of the London meetings some seventeen years since by the late lamented Professor Vivian B. Lewes, who also suggested blue water gas for a similar purpose.

In removing the toluol, all, or nearly all, the condensable hydrocarbons—*i.e.*, benzene, xylene, toluol, &c.—are removed by the washing oil or tar; so that if a measure of the condensable hydrocarbons or hydrocarbon vapours can be made at the inlet and at the outlet of the washer, the amount of work done by the washing can be obtained, and a fair estimate of the quantity of toluol removed can be found, especially if the amount at the inlet of the apparatus has been determined by the washing test.

There is at least one way in which this can be done—that is, by making a determination of the condensable hydrocarbons or hydrocarbon vapours at the inlet and outlet by means of alcohol in the Hempel apparatus.

The Germans have shown us how necessary organization is, and they have also shown how very much we were behind in allowing the products from gas-works to be exported and treated in their country—only sending back the manufactured article for sale. Consequently, we were becoming shopmen and shopkeepers. How much, or rather how little, toluol was there in this country when the war broke out?

OBSERVATION.

With all the theoretical and practical training available, there is one thing which requires emphasizing upon the younger generation—viz., the cultivation of the power of observation. One of the greatest engineers has remarked, "After all has been said, it is only by observing that we know." Knowledge comes along that line. Among so-called uneducated people, this power is possessed in a larger degree than is often realized. The workman who observes is far more valuable than one who does not. He becomes more or less an inventor, and adapts certain tools and places to suit his own particular work.

Let me urge a movement by the members to afford the youth of the gas profession greater opportunities for becoming engineers, draughtsmen, chemists, tradesmen, skilled artisans, &c., by supporting such movements as lead to the fostering of all such ideas. Increased opportunities of this kind for our youth would reveal the inherent inventiveness of our race in the arts and crafts of peace.

QUALITY OF GAS.

One of the most important subjects to ponder is the quality of the gas issued from the works. Having regard to the necessities of the Munitions Department, gas undertakings are in some instances being tempted to strip the gas of its illuminating and heating constituents to an undue extent. Regard and careful attention must be paid to the requirements of the gas consumers, or the goose which lays the golden egg may be killed, and then whence will come the eggs? Consideration must be had to maintaining some reasonable amount of illuminating and heating constituents in the gas. What is the use of light, so called, which will not illuminate, or gaseous fuel which will only emit a pungent odour? *Verbum sap.*

COAL STORAGE.

The question of coal storage is nowadays one of supreme importance. In colliery districts, it has hitherto been considered that a maximum month's storage of coal is sufficient. I have always advocated from ten to twelve weeks' maximum storage. This is a subject which will have undergone careful reconsideration during the war; and the ultimate outcome of the experiences and possibilities remains to be ascertained and determined. The deterioration of coal is very small, while the security against emergencies and fluctuations in market price is thoroughly sound.

COKE STORAGE.

The desirability of preventing the accumulation of a stock of coke still holds good. The rapid disposal of surplus coke is always a wise one. The normal local requirements having been provided, the surplus coke should be sold at the best prices obtainable. This is a subject which may not require immediate consideration, under present conditions; but it is one which must not be forgotten.

TAR DEHYDRATION.

So recently did Mr. E. V. Chambers, of Huddersfield, present a valuable paper to this Institution upon this subject, that it is probably too soon to dwell upon it again. The general principles in my opinion hold good, although the prices suggested have passed out of existence, through the ever-varying market conditions. Later, we may hope for a further contribution from such an authority.

The really magnificent work accomplished by the distinguished Engineer and Manager of the Road Board (Mr. H. P. Maybury, M.Inst.C.E.) deserves more than passing recognition. The great value of his efforts will be more apparent in the future.

LIQUID PURIFICATION.

We cannot but deplore that little has been accomplished upon a practical basis, in the matter of purifiers filled with liquid, required to be drained off and refilled from overhead tanks. Solid purification still holds the field. The magnificent experiments with the Claus system carried out by Mr. Charles Hunt, M.Inst.C.E., at the Birmingham Gas-Works some years since, have not been followed up, as might have been expected. All the same, Mr. Hunt placed the gas profession under a lasting obligation in this matter, as in many others.

VERTICAL OXIDE PURIFIERS.

While various designs are extant, they have not made their practical appearance, to my knowledge. Certain it is that the economy in ground area, as in the case of vertical retorts, warrants their trial—especially having regard to the use of machinery for the filling and emptying of the material. It is well known that Messrs. Clapham Bros., of Keighley, have for some years dealt with this subject.

SULPHUR COMPOUNDS.

With reference to the question of the use of oxide of iron, it is valuable to refer to a paper by so distinguished an authority as Dr. Samuel Rideal, in June, 1903, entitled "Coal-Gas Standards," in which the following paragraph appears:

> "As lime only arrests 2 or 3 per cent. more of the total sulphur than oxide of iron, the disadvantages and costs attending its use more than outweigh any possible theoretical benefit accruing to the consumer by the removal of this small amount of extra sulphur. In London alone I calculate that more than one thousand times as much sulphur is contributed to the air by the coal consumed as by the gas supplied, and that the sulphur impurity developed from illuminating petroleum in London at the present time is practically equal to that derived from coal gas."

Before a Committee of the House of Lords in June, 1903, the late Sir George Livesey, when cross-examined by Mr. Freeman, K.C., stated as follows:

> "I have been in the gas industry for fifty years, and it has never been proved that sulphur compounds caused any injury to health. In fact, I believe a little sulphur burnt in a room is good for health."

SULPHATE OF AMMONIA.

The splendid work accomplished by the Sulphate of Ammonia Association, under their able Chairman, Mr. D. Milne Watson, demands whole-hearted support from all gas undertakings. To give the aims of the Association would take longer time than is at present available; but one may refer to the splendid brochure issued in July, 1915, entitled "The Market for Sulphate of Ammonia—and its Future," a copy of which may be obtained from the Secretary (Mr. A. Dawson).

In this connection, let it be stated that it is my belief that all gas-works, however large or small, generally speaking, should be provided with a sulphate plant available for emergencies, which are always liable to arise. Like all other plant, its value could be depreciated annually according to its prospective life.

MAIN AND SERVICE LAYING.

Arising out of the present strenuous times will be the subject of extended or restricted main-laying. In speaking of this, it is proposed to adopt the generally accepted definition that main pipes are cast-iron ones and services wrought-iron ones.

To what extent are gas undertakings justified in extending main and service pipes, is a most important question? As conditions vary so largely, it is quite impossible to lay down any hard-and-fast rule applicable to all cases. In outlying districts, it was formerly the practice to charge the full cost of the main, although laid in the public highway, to the property owner. Later, a more generous and businesslike policy prevailed; and a charge of one-tenth of the capital cost was made. At the present time any progressive undertaking would probably be willing to lay a gas-main along a public highway, free of cost, for a distance of 100 yards or more, according to the estimated consumption of the premises to be supplied. Where there are considerable extensions of property contemplated, a much larger consideration than this would even be given. In the case of wrought-iron service-pipes, some time since it was the almost invariable practice to charge for their full cost, from the main in the public highway up to the meter inlet. More recently, the service-pipe was charged from the entrance to private property; while some undertakings charge for all work executed beyond 30 feet. At the present time, many are prepared to lay the service-pipes free to the inlet of the meter, and also fix the meter and all stoves required free of charge.

One rule sometimes adopted is to estimate the cost of the main to be laid, and to insist upon the estimated revenue being such as will pay for the interest and sinking-fund charges upon the same.

In my opinion the immediate financial consideration should not be paramount, as a new consumer being acquired (even at a small loss) may mean an addition eventually of other consumers, nearer home, who would be a direct source of profit to the undertaking. Moreover, the use of gas in outlying districts is sure to have a beneficial effect upon friends of the occupiers in the town. A

further important consideration is that often when a main is laid in a public highway to an outlying district, lamps are placed to the great convenience and safety of the public. These lamps may hardly be considered as profitable revenue earners, but their value is recognized from a public standpoint. This may not be operative as a consideration in the case of a company; but it is nevertheless worthy of notice to gas undertakings interested in the prosperity of the municipality.

The extension of gas-mains and other services into the outlying districts has frequently been followed by extension of property, which must have a distinct effect upon congested districts of population. The utilization of gas for lighting, heating, and motor purposes renders its presence in the smallest hamlet, or even upon farm premises, a valuable acquisition and economy.

Up to a late date the fixing of meters has been charged for; but this charge has now pretty generally been abolished. There can be little doubt as to the advantage accruing to a gas undertaking by adopting a generous policy with respect to main and service laying. The desirability of charging a rent for gas-meters is in my opinion unquestionable and should be retained.

I do not recommend the fixing of the internal gas-fittings free. In my judgment, these should be paid for by the owner or tenant, as with a change of occupier or owner complications are always likely to arise as to the ownership of the pipes and fittings.

Respecting the main-laying operations, in most towns the main is laid on one side of the street, which is an imperfect arrangement. It is much better, whenever possible, to have a main on each side of the street—thus avoiding the necessity of damaging the street when laying a new service, renewing an old one, or any other examination required. The practice of cutting a channel, or crossing the street, is objectionable, especially in towns where there are tramway lines laid upon a concrete bed.

Whenever possible, mains should be connected to form a circuit, instead of finishing at a dead-end. The circulation and equal distribution of the gas well compensates for the extra cost involved. It is also clear that in the case of a broken main, necessitating bagging, both sides have a supply available. Indeed, I am so satisfied upon the point that I would almost recommend in a cul-de-sac that the gas-mains should be tied across at the end of the street. Moreover, where gas has remained in the pipe for any length of time it deteriorates; and until it is used it is a fertile source of dissatisfaction to the consumer.

In examination for gas escapes, unless the defective place can be at once located, it is desirable to examine the service pipes first before proceeding to strip any portion of main, unless there is positive evidence that the main is broken.

Let me be permitted to remind members that one of our honoured Past-Presidents, Mr. John C. Belton, has introduced a special form of "Facile" syphon, which is the outcome of practical experience. This syphon possesses numerous advantages, and is well worth adopting. I have used it with considerable benefit, as doubtless have many others.

At the conclusion of the war, it is quite possible that a large number of unskilled workmen will be available, who could advantageously be employed in developing the distribution system.

OTHER MATTERS OF NOTE.

Reference to condensation, scrubbing, washing, high-pressure lighting, and many other matters has been omitted for want of time; but I would suggest that they might each form the subject of a separate paper by a member to the edification of all.

INCREASED CHARGES FOR GAS.

There has been, and will continue to be, a hue and cry and grumbling about gas charges being increased. These increases are only the natural outcome of the augmented prices of coal, labour, and all else required. Every household commodity has necessarily increased; and yet it is considered outrageous that gas should follow suit. The fact is the public has got used to constant reductions. In Huddersfield, during my term of office, the charges for gas were reduced all round by 9d. per 1000 cubic feet; and yet a slight increase, to provide for war emergencies, is freely criticized.

I have here a handbill calling a public meeting of protest against the arbitrary action of a gas company in the district increasing the price of gas. Surely the conveners must have heard that a war is raging.

GAS-WORKS CONTROL.

With your permission, I should like to say that the most efficient control is generally effected by a small board or committee. It is common knowledge that large meetings are always factious and unjust. Number always rapidly diminishes the responsibility of each member for his vote. The voting value of each member is the percentage of his personality. If there are a hundred members, then each member is constituted 1 per cent., and he becomes irresponsible. If there are ten members, then each member is of ten times more value than represented in the former case, and so on. Hence the value of small committees, where important work has to be transacted.

LABOUR QUESTIONS.

Does not the question of how to interest the workmen in their work arise as an important one? This problem remains unsolved. All schemes of co-partnership may be a step in the right direction, but are only a step; closer union is required. How to obtain it is the difficult matter. Annual outings and various entertainments only touch the fringe, if at all. There is something "rotten in the state of Denmark," when the aged and infirm go from a factory to the workhouse. Education has accomplished little. The reformation must come from within the man—from his own steady will and purpose. Everything external appears useless.

It may take time, generations possibly. Any sign of consideration and kindness is mistaken for weakness by the workmen and boards of control. It is wrong to assert that how a man spends his leisure time has nothing whatever to do with his work. It has a great deal to do with it. Are the younger men invited to improve their leisure time, or discouraged? Let the man himself be cared for properly by his employers.

A workman's well-being is not dependent upon the amount of remuneration but upon the conditions of employment, the treatment from his superiors in office, the amount of appreciation and encouragement bestowed, coupled with any or many other little amenities of life. These all contribute towards making work a pleasure.

Anything which interferes with the worker's comfort and cannot be proved to be essential, is an abortion, and should be abolished. On the other side, the workman has his obligations and should recognize them.

To my mind, one of the ways to increase the efficiency and happiness of the workers is to endeavour to establish a personal and sympathetic understanding between the employers and employees. This is as nearly as I can determine the root of the matter. The workman should be enabled, and even encouraged, to get into personal touch with his employer. Too often only an indefinite board or committee exists, whom the workman imagines has no soul, and consequently no more consideration for him than for his shovel.

The Ministry of Munitions has issued excellent reports upon industrial canteens and welfare supervision, which doubtless many of you have purchased.

It will be remembered that the "Health of Munition Workers Committee" was appointed with the concurrence of the Home Secretary, "to consider and advise on questions of industrial fatigue, hours of labour, and other matters affecting the personal health and physical efficiency of workers in munition factories and workshops." The investigations and recommendations of the Committee are well worth the study of every employer of labour.

HUDDERSFIELD.

It is usual for a President to make some reference to the town in which he resides. The area of the county borough of Huddersfield is 11,859 acres, and the population at the last census (1911) was 107,825. A solid foundation has been laid by a past wise generation, as instanced in the fine public services available. The gas, water, electric, tramways, markets, fairs, abattoirs, hospitals, cold storage, baths, cemeteries, and last, but not least, a fine technical college are all owned by the Local Authority. Should there be any philanthropic person, in a difficulty as to the disposal of his surplus wealth, let me suggest a few suitable channels, such as a public library, an art gallery and museum, and a few hundred almshouses where the aged and infirm may spend their last few years in peace and comparative comfort. For the past twenty years I have insisted that Huddersfield will eventually become another Manchester. With the advent of "British Dyes Limited" and other works, it is on the high road to further great development. The public services in many directions are ready for more work. The Midland Railway have brought their system into the town, but are apparently awaiting the trend of events before erecting passenger and goods stations with a hotel worthy of the Company. The town has been for many years anxiously awaiting this crowning event.

OUR INSTITUTION.

In my opinion this Institution has now grown to such a size, position, and importance as would justify the granting of a certificate of membership, which should possess some real value.

In conclusion, let me urge upon the members an increased interest in the Manchester District Institution of Gas Engineers and its objects, as well as to each other individually—certain as I am that in doing so we shall best serve the profession of which we form an integral part.

By a happy inspiration, the President concluded his address with Longfellow's well-known exhortation.

> Let us then be up and doing,
> With a heart for any fate,
> Still achieving, still pursuing,
> Learn to labour, and to wait.

THANKS TO THE PRESIDENT.

Mr. NEWBIGGING said he rose with very great pleasure to propose a vote of thanks to Mr. Harman for his address. If the address might be taken as a criterion, he was sure a very successful year of office was assured to him. Having had to prepare an address himself, he knew something of the difficulties connected with it; and it made one wonder what the next occupant of the chair would have to say. Mr. Harman, however, seemed to have had no difficulty in this respect. His address was full of the dry humour and philosophy which were natural to him. Of course, as a consulting engineer, he had not expressed definite opinions

on any subject [laughter]; but they were nevertheless very much indebted to him for it.

Mr. J. H. Brearley (Longwood), speaking as a twenty years' neighbour of Mr. Harman's, said he had listened to the address with considerable interest and pleasure. He noticed he had eulogized Huddersfield a good deal, and was of opinion that it would eventually become another Manchester. This was an interesting feature, and he thought it would be a good thing for Huddersfield if it developed on the lines portrayed in the presidential address.

The vote having been carried by acclamation,

The President briefly returned his thanks.

Naphthalene.

Mr. Henry Simmonds, F.C.S., of Bury, then read his paper on "Naphthalene," which, together with some of the remarks upon it, will be found on this and succeeding pages.

Carbonization of Pitch.

Mr. Tim Duxbury (Oldham) afterwards gave some important figures on "The Carbonization of Pitch," which, with subsequent remarks made by members, bearing upon the question, will be found on p. 482.

Thanks to the Authors.

The President said they had had very interesting papers from Mr. Simmonds and from Mr. Duxbury. They would doubtless take the earliest opportunity of thoroughly studying them, for they would certainly well repay close study.

Mr. J. P. Leather (Burnley) moved that the heartiest thanks of the members be accorded to Messrs. Duxbury and Simmonds for their valuable contributions. He confessed that, when he himself read a paper on naphthalene many years ago, he thought he had said the last word on the subject, and that he had settled the matter once and for all. [Laughter.] At the same time they had been very glad to have another paper on the subject, if only because it emphasized points which needed emphasizing. They had all been delighted with Mr. Duxbury's data. He had provided them with an exceedingly valuable contribution.

Mr. G. W. Tooley (Manchester) seconded the vote; and it was cordially agreed to.

The authors briefly returned thanks.

On the proposition of Mr. R. G. Shadbolt, seconded by Mr. William Smith, a very hearty vote of thanks was passed to the retiring President, Mr. J. G. Newbigging, the Vice-Presidents, the Hon. Treasurer, the Hon. Secretary, the Committee, and other officials of the Institution for their excellent services during the past year.

NAPHTHALENE.

By Henry Simmonds, F.C.S., of Bury.

[A Paper read before the Manchester District Institution of Gas Engineers, Saturday, Feb. 26.]

I do not propose to give you a long paper on naphthalene, but rather a short account of the means we have taken at Bury to reduce the number of complaints to a minimum. I think I can say that in the last twenty years we have had more papers written on this matter than on any other subject. Naphthalene is an old enemy, and most of us have made its acquaintance. Many gas engineers have devoted much of their time to it; and we are indebted to Messrs. Botley, of Hastings, Mr. Ferguson Bell, of Derby, and the late Mr. William Young for their investigations. The increased number of stoppages recorded last year is, I trust, sufficient reason for raising the question anew.

The advent of the regenerator furnace in the retort-house was the beginning of naphthalene troubles. The high temperatures employed to carbonize the coal to obtain large volumes of gas, and the cracking-up of what at lower temperatures would be left as tar, mean decreased quantities of oils in the gas, and more naphthalene to be dealt with in the mains and services. Again, the extraction of toluol and benzol from the gas by the "C" process has not helped matters, and no doubt was responsible for the increased number of complaints that many gas managers had to deal with during the last twelve months.

I have tried many processes for the cure of naphthalene; but I think it will be sufficient if I give the results obtained and the methods used for the last three years—1913 to 1915 inclusive. In the year 1913, "Solvene" was used in a Livesey washer at the approximate rate of 30 gallons a day in summer and 15 gallons in winter. The washer was placed at the inlet of the purifiers. There were used 7000 gallons, equal to 0·202 gallon per ton of coal carbonized; the stoppages recorded being 2162. No doubt we experienced a certain amount of relief, although it was somewhat disappointing to find at times complaints jumping up to 30 and 40 per day. Small quantities of oil highly charged with naphthalene were found in the district syphons. One objection found with "Solvene" was the injurious effect it had on the paint of the gas-holders.

For the year 1914, Russian vaporizing oil was used in a vaporizer, the connections to which were so arranged that the apparatus could be worked on either the inlets or the outlets of the gas-holders. It was chiefly worked on the inlet, as the volume of gas flowing in that main was practically constant. Some 5846 gallons were used, equal to 0·177 gallon per ton of coal carbonized. The stoppages recorded were 3428. The highest number of stoppages we ever had was 60 one day in November. A residue of 15 to 20 per cent. was pumped out of the works' syphons; this being used up in a Livesey washer. No trace of oil was found in the district syphons.

Not being satisfied with the results so far obtained, I decided to try atomizing the oil with compressed air. Fig. 1 shows the general arrangement of the apparatus, which was fixed in the governor-house; the atomized oil passing direct into the towns' supply. The oil storage tank, tested to 100 lbs. pressure, has a capacity of 150 gallons. The air required to work the apparatus is taken from the West's air compressor (used for stoking machinery). This is reduced to 25 lbs. by the reducing valve, as shown on fig. 1.

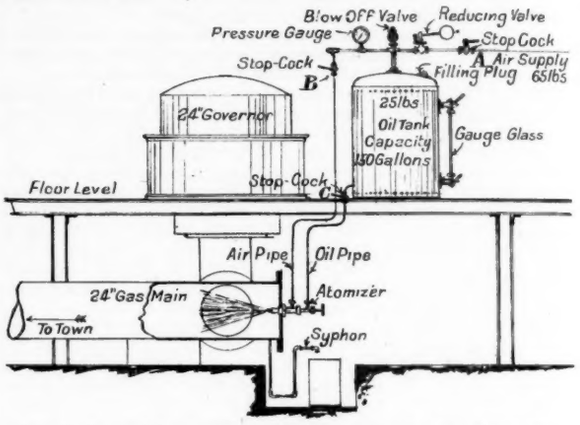


Fig. 1.—General Arrangement of the Apparatus for Atomizing Oil.

The photograph (fig. 2) shows the atomizer, which is fixed in the 24-inch main on the outlet of the governors. It is supplied with oil and air at 25 lbs. pressure by two ¼-inch pipes; the oil being regulated by means of a spindle and dial, and the air by the size of the hole in the spray nozzle. The atomizer was tested to pass

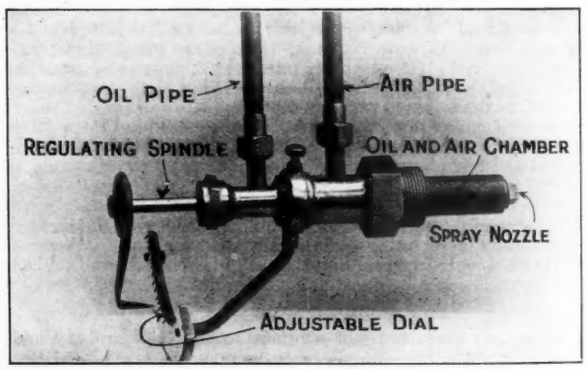
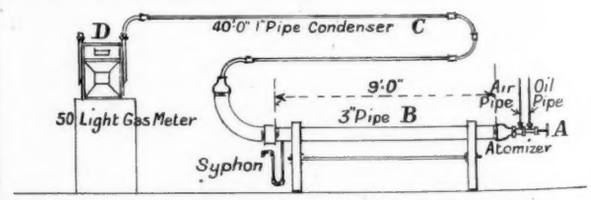


Fig. 2.—The Atomizer.

one gallon of oil per hour; and to get this quantity atomized, the hole in the air-nozzle was gradually enlarged until it gave a good permanent spray without drip. Before fixing the atomizer in the gas-main, further tests were made to ascertain the amount of air required to atomize the oil. This was done by fixing up the apparatus shown in fig. 3.



A. Atomizer. B. Expansion Tube. C. Condenser. D. Fifty-light Gas-Meter.

Fig. 3.—General Arrangement of the Apparatus for Testing the Atomizer.

The following results were obtained:

At 25 lbs. Pressure.	Cubic Feet per Hour.	Oil per Hour.
Air	220	*Nil*
Air and oil	200	1 gallon

The plant was ready by the first week in January, 1915; and as the local authorities had issued instructions restricting the lighting at night of the street-lamps, it was decided to work the apparatus from 6 a.m. to 12 p.m.—eighteen hours daily. To start the plant, the plug taps A, B, C (fig. 1) are opened; this being done by the works' foreman.

Trials were made with different kinds of oils. The light naphtha ('770 specific gravity), a distillate of shale tar supplied by the Pumpherston Oil Company, was found to give the best results; and this has been continued the whole twelve months. Two jet photometers which had been carefully standardized by the bar were fixed—one before and one after the atomizer. No appreciable difference in the illuminating power could be detected. Tests made for calorific power showed a slight increase, probably due to the heating value of the oil (138,600 B.Th.U. per gallon), more than counterbalancing the small percentage of air required to atomize the oil.

Working Costs.

Oil atomized, 5709 gallons		£230
Less aërated oil mist, 200 cubic feet by 18 hours by 365 days, at 2s. 4d. per 1000 cubic feet	£152	
577 gallons of residue at 3d.	7	
		159
Total cost		£71

Equal to 0·51d. per ton carbonized.
,, 0·042d. per 1000 cubic feet.

The results [see Appendix No. 1] are certainly a great improvement on anything accomplished before, and have given a good deal of relief to the depleted outdoor staff. During the twelve months the apparatus has been in operation the number of stoppages from naphthalene have been the lowest recorded, despite the fact that many works in the country have experienced considerably more trouble than in former years; the increase being attributed to washing the gas with tar for the extraction of toluol and benzol, which in our own case has amounted to an additional 0·204 gallon per ton of coal carbonized (see Appendix No. 2). The oil atomized for the year was 5709 gallons, equal to 0·176 gallon per ton of coal carbonized, which is 0·028 gallon less than had been extracted by the "C" process. Of the atomized oil, 10 per cent. condensed in the mains, and was recovered from the syphons. At first the oil was found in the syphons near the works, then each week it got a little further away, until it had reached the limits of our supply, some three miles off.

The result of these three years' investigations have proved conclusively to my own mind that atomized oil is far more efficacious for the prevention of naphthalene deposits than oil in any other form—it retains its oily nature, which permeates the whole system of supply, condensing out with the naphthalene deposits. The initial cost of the oil is reduced by the aëration.

The gas is manufactured in horizontal retorts charged by the De Brouwer and the West stoking machinery; the make per ton from rough Arley slack being 12,000 cubic feet, 500 B.Th.U. net. The naphthalene found in the gas varies from 3 to 5 grains per 100 cubic feet.

I would not have agreed to address you on this subject had I not felt confident that we have at Bury reduced very largely the annoyance and trouble caused through naphthalene stoppages; and I trust the information given to you will be of assistance in helping some of the members of the Institution to combat what has been the bugbear of the gas manager for many years.

DISCUSSION.

The PRESIDENT (Mr. Edward A. Harman) said he was sure they were very much obliged to Mr. Simmonds for his interesting paper. All members who had ever heard of naphthalene would doubtless want to make some remarks upon the subject.

Mr. J. G. NEWBIGGING (Manchester) said that in the first place he should like to say how pleased they all were to see the author taking an active part in the work of the Institution. He hoped that in the future he would give them the benefit of his wide experience in gas-works matters. He (the speaker) had hoped the author was going to give them the cure for naphthalene, but it seemed that he had only given them a palliative. He stated that the gas was manufactured in horizontal retorts charged by the De Brouwer and West's stoking machinery. In the case of West's machinery, he did not fill the retorts. Did he experience greater trouble from those than from the retorts charged by the De Brouwer process—the last-named being fully-charged if the workman was properly watched? Unless the conditions in the years 1913, 1914, and 1915 were identical, he was afraid the conclusions that the author had come to as to the atomizing of naphtha were not very conclusive. Naphthalene was such an elusive product that, unless the conditions were identical, it was quite impossible to say that one remedy was better than another. Of course, what they ought to do was to tackle this trouble at its root; and there was no doubt about it that it could be done in the carbonizing plant. He might give an instance. They had had vertical retorts at Droylsden now for five or six years, and they had never had one single case of naphthalene. He (the speaker) had made particular inquiries into the question only that morning, and found that they had been entirely free. He thought that rather than use these palliatives, it was much better to tackle the evil, as he had already said, at its root. Personally he was much indebted to the author for giving them an account of a means of reducing the evil; but he had hoped, knowing him as he did, that he was going to give them the absolute cure.

Mr. H. KENDRICK (Stretford) said he cordially endorsed what

APPENDIX No. 1.

Solvene in Livesey Washer. Sp. Gr. ·924. 1913.	Oil Used in Gallons	Oil Used per Ton of Coal Carbonized.	Residue in Syphons.	$C_{10}H_8$ Stoppages Recorded.
January . . .	354	·064	A little oil recovered from district.	107
February . .	350	·100		66
March . . .	400	·126		48
April	480	·156		48
May	552	·212		95
June	772	·332		279
July	930	·425		349
August . . .	930	·376		401
September . .	813	·281		163
October . . .	503	·132		124
November . .	510	·127		251
December . .	406	·087		230
Total . . .	7000	·202		2162
Number of consumers . .	16,054			
,, public lamps .	2,548			

R.V.O. in Vaporizer. Sp. Gr. ·824. 1914.	Oil Used in Gallons.	Oil Used per Ton of Coal Carbonized.	Residue in Syphons.	$C_{10}H_8$ Stoppages Recorded.
January. . .	450	·098	15 to 20 per cent. recovered from works used up in Livesey washer.	257
February . .	207	·061		45
March . . .	200	·058		46
April . . .	200	·072		19
May	300	·145		163
June . . .	379	·176		515
July. . . .	690	·262		635
August . . .	534	·280		244
September .	600	·239		301
October . .	836	·273		288
November .	850	·212		622
December .	600	·157		293
Total . .	5846	·177		3428
Number of consumers . .	16,487			
,, public lamps .	2,569			

Naphtha in Atomizer. Sp. Gr. ·770. 1915.	Oil Used in Gallons.	Oil Used per Ton of Coal Carbonized.	Residue from Street Syphons in Gallons.	$C_{10}H_8$ Stoppages Recorded.
January . .	171	·081	45	97
February . .	330	·092	42	72
March . . .	392	·121	50	18
April . . .	282	·108	41	8
May . . .	404	·186	30	20
June . . .	560	·267	30	163
July. . . .	627	·280	57	94
August . .	526	·244	36	69
September .	714	·281	50	161
October . .	572	·190	75	135
November .	662	·152	64	277
December . .	469	·150	57 Used up in Livesey washer	119
Total . .	5709	·176	577	1233
Number of consumers . .	16,894			
,, public lamps . .	2,575			

APPENDIX No. 2.—*Toluol and Benzol Content Extracted per 12,000 Cubic Feet of Gas.*

—	Before C Process.	After C Process.	Increase.
	Gallons.	Gallons.	Gallons.
Toluol	·046	·091	·045
Benzol	·064	·223	·159
Total	·110	·314	·204

APPENDIX No. 3.—*Analysis of Oil Used in Atomizer and Deposited in Syphons.*

	Degrees C. Per Cent. Distilled.									
Sp. Gr.	120°	130°	140°	150°	160°	170°	180°	190°	200°	Remarks.
·770	..	..	..	*Nil*	21	47	67	81	90	Oil used in atomizer.
·850	..	1	4	10	15	19	26	35	44	Oil collected from street syphons.
·870	..	1	9	14	20	24	31	40	50	do.
·875	..	2	9	15	21	26	32	42	54	do.
·830	..	..	..	..	4	9	15	25	42	do.
·850	..	..	..	..	..	2	12	24	40	do.

Residue above 200° C. thick pasty mass.

the last speaker said regarding the pleasure it afforded them to have a paper from Mr. Simmonds. At the same time he might, perhaps, be permitted to reply to Mr. Newbigging. It was all very well for Mr. Newbigging at the head of a big undertaking to go in for vertical retorts; but they were not all circumstanced alike. His remarks were well and good if they were going to build new works and scrap existing ones; but that was going to be a costly way for some of them to get rid of their naphthalene troubles. It was a tall order to consider. From his knowledge of the author's figures, he thought he would have a very good answer to Mr. Newbigging. He (the speaker) happened to have been in the unfortunate position of having as many naphthalene cases in a day as the author reported having had in a month; and he went to Mr. Simmonds for some information as to getting relief. He had, at Stretford, the apparatus which Mr. Simmonds said he had used for twelve months; but it was not yet at work. It seemed to him that the figures which the author gave for 1915 were a very great advance upon those for the two previous years. It was quite certain that the conditions were not the same. Those members who had been extracting toluol by the "C" process had a very vivid recollection of what occurred during the months of September, October, and November, when naphthalene stoppages came in by the hundred in a day. This was entirely due to the depletion of the carriers taken out of the gas, and, in his case, the impossibility of getting the carriers which he was in the habit of adding to the gas to get rid of the difficulty. Mr. Simmonds said he had been extracting toluol; so that, to compare his figures with the previous years, they would have to take the figures on a works in which the process had not been adopted. If he (the speaker) were to correct the figures for 1915 with his own experience, he would have to add about 6000 to his naphthalene stoppages; so that, in proportion, the cases would have been the same if it had not been for the apparatus which he had in use. He considered that what the author proposed to them was something more than a palliative.

Mr. SIMMONDS: Have you the same number of consumers?

Mr. KENDRICK: About the same. The number of stoppages were practically 7000 during the twelve months. The speaker added that he used practically every solvent he could get hold of; but it was not until he stopped tar-washing for a time, and used a heavy naphtha in its place, that he got free from naphthalene in the district. Of course, this was additional expense; and he did not keep at it any longer than was absolutely necessary. Ordinary petroleum had been mentioned to him since he had been in the room, as a possible means of getting rid of naphthalene. He found, however, that practically the whole of the petroleum (which they vaporized at the highest temperature they could get, about 100 lbs. steam pressure to the square inch) was deposited in the mains in the immediate vicinity of the works, and that practically no relief at all was obtained beyond half-a-mile from the works governors. That was to say that, within a circle of half-a-mile of the works, they had very few naphthalene stoppages. It was outside this area that they occurred. Benzene was tried, and with almost the same effect. They had, however, been in the habit of having a Scotch oil which was very much more effective for the purpose. He was sure the information the author had given them as to the very sensible method he had adopted to successfully reduce his naphthalene stoppages would be of benefit to the members. They would all join with him in thanking Mr. Simmonds for the figures and for the apparatus he had placed before them that afternoon. He cordially agreed with Mr. Newbigging, when he said he hoped they would have further interesting contributions from Mr. Simmonds.

Mr. NEWBIGGING said that Mr. Kendrick spoke of 7000 naphthalene complaints. Did this include lamps and services?

Mr. KENDRICK: Service-pipes only. You may add another 7000 on the top of that, to include everything.

Mr. F. H. ROBINSON (Harrogate) said that in times gone by they had had considerable trouble with naphthalene at Harrogate, but a few years ago they commenced washing their gas with a solvent at the outlet of the station meter in a washer of ample capacity. In addition to this, they had used atomized oil steam-heated, approximately of a specific gravity of about ·8. While this was in use in the summer of 1914 (which was a hot summer for Harrogate), they had a few complaints varying from 20 to 40 per day; but this was not the only trouble. They found in certain cases the meters contained about 4 gallons of a dirty brown liquid, which, after being analyzed, was found to contain 60 per cent. of water, and 25 per cent. of a liquid distilling at 90° C., and 15 per cent. of fatty matter. Then, again, they did not know whether this came from the solvent or from the petroleum they were using. However, on testing the solvent, they found that 95 per cent. of it distilled at 90° C., and the remainder was anthracene. It seemed to him that this might have some bearing on the question of the deterioration of the diaphragms of dry meters recently mentioned by Sir Corbet Woodall, and perhaps the subject would bear a little research on the part of their chemical friends, so that they could arrive at some solution of the difficulty.

Mr. S. MEUNIER (Stockport) said the question of naphthalene "had been a friend who had stuck closer than a brother to them." They had had it for years, but had never been able to cure the evil. At Stockport they used to be considerably troubled at one time, and found it was getting worse, or appeared to be. Following somewhat on the lines suggested by Mr. Botley, they manufactured a little apparatus of their own to deal with the trouble. The shell was formed of the outside casing of an exhaust steam-feed water-heater; and they introduced a spray, injecting oil with steam pressure of about 60 lbs. to the square inch against the flow of gas. The oil was obtained from Mr. Colson, of Leicester, who at that time was specially preparing it for naphthalene troubles. They found fairly good results, and ultimately used the same material in a Livesey washer. Both systems had an appreciable effect on the naphthalene trouble, but did not cure the evil. He was rather inclined to coincide with the opinion of Mr. Newbigging that the proper thing to do was to prevent the formation of naphthalene. He had this year made some alterations in the hydraulic mains at Stockport, and had found his method to be entirely successful. It would appear as if the necessity was to extract the heavy tars from the hydraulic main as rapidly as possible, because, as was well known, the heavy tars, if left in contact with the lighter hydrocarbons, had a powerful effect upon them, and prevented them acting as carriers for the naphthalene. It would appear to him as if the primary object of gas engineers of to-day should be to, as far as possible, allow the lighter hydrocarbons to go forward with the gas, and to endeavour to ascertain the best means of attaining the object in the carbonizing plant. One of the earlier speakers had mentioned the effect of certain materials used for curing naphthalene troubles on the diaphragms of dry meters. He (Mr. Meunier) had happened to have an analysis made of some of the material found therein, and it showed 48 per cent. of vegetable oil, with a small percentage of the lighter hydrocarbons; the great bulk being heavy oils and naphthalene—the latter being about 19 per cent. of the original solvent used. Reverting to the experiments on the hydraulic mains, the speaker said this year his naphthalene trouble had been very mild indeed—in fact, it had been so small that they had practically nothing to do in the way of complaints. It certainly appeared to him the first principle was to try to nip the trouble in the bud if possible; but, failing this, he thought the author's method of mending the trouble was a simple, and a very fine, one. He heartily welcomed Mr. Simmonds's contribution to their "Transactions," and hoped that before long he would give them some more of his practical knowledge in gas matters.

Mr. P. D. WALMSLEY (Wombwell) said he had listened with very great interest to the paper, and also to the remarks made by the different speakers on the naphthalene question, but he had not heard anyone suggest a remedy for effectively relieving the trouble. They had heard about various "partial remedies" for removing the naphthalene content of the gas, and these were doubtless more or less effective; but, as he had already stated, no reference had been made, as yet, to a method which would get rid of the naphthalene altogether. Members were given to understand that the production of benzol and toluol for Government purposes was of primary importance, and they had a remedy to hand whereby they could get the maximum amount of toluol and benzol from the gas, and at the same time completely rid it of naphthalene—that was, to wash the gas and completely strip it of these constituents by means of creosote oil. They, at Wombwell, had lately installed a plant for completely stripping their gas of all illuminating power, and subsequently recovering the benzol and toluol as crude benzol, which was afterwards sent away for rectification at a local rectifying plant. It was, however, their intention at a future date to instal a rectifying plant of their own, providing they could get quantities of oil to treat from neighbouring works. When they adopted the "C" process they had very numerous complaints of naphthalene stoppages; but since carrying out their present process the complaints had disappeared altogether.

Mr. S. TAGG (Preston) congratulated the author on the very businesslike paper he had given them. He rose with the object of eliciting further information. The author had given them three different tables in his appendix (1913, 1914, and 1915); and he noticed that the rough average of stoppages per day was about seven in 1913, when using "Solvene" in the Livesey washer; nine per day in 1914, when using Russian oil in the vaporizer; and only three or four per day in 1915, when using naphtha in the atomizer. But there were no figures to show the number of complaints prior to the adoption of any means for preventing naphthalene stoppages. If the author could give them some idea of this, it would enable them to judge what the effect had been of his efforts to eliminate the trouble. Was the assumption that the reduction in the number of naphthalene complaints was due to the method in which the naphtha was admitted or admixed with the gas? because the difference between 1915, when naphtha was used in the atomizer, and 1914, when the vaporizer was in use, was very striking.

Mr. J. P. LEATHER (Burnley) said that he had considered the naphthalene question for some time now; and a few years ago he contributed a paper on the subject at a meeting of the Institution of Gas Engineers. He investigated Mr. Botley's process, and went down to Hastings to see it. He thought there was some little difference in putting the oil into the gas as a spray, and putting it in in the form of a vapour. It did not necessarily follow that the vapour in the gas was condensed in the form of a mist. After alluding to some of the experiments he witnessed at Hastings, the speaker went on to say that he had found a perfect cure for naphthalene trouble by washing the gas with a heavy oil. He had been greatly interested in what Mr. Walmsley had said as to washing and stripping the gas of its toluol and benzol constituents by means of creosote oil. Just before that gentleman spoke, the thought occurred to him whether it was necessary, even if they produced the naphthalene, that it should go forward.

Again, he could not help thinking that a great deal of the trouble which many members had experienced since the introduction of "C" process was because they had not had their tar cool enough. If they tried to approach as near as they could to a mathematical conclusion as to what naphthalene they ought to have in the gas after washing with tar, he thought they would come to the conclusion that there ought not to be much naphthalene in the tar at a temperature of 60° Fahr. Replying to an interjection that was inaudible to the shorthand writers, the speaker was understood to say that he certainly thought it would be necessary to use something in the way of refrigerators if they were going on to extract toluol from the gas during the coming summer, and especially if it turned out a very warm summer. It had also occurred to him whether it might not pay them to have certain arrangements for cooling the gas to the temperature really wanted. This point had, perhaps, occurred to him because of the special circumstances under which he was placed regarding water for cooling.

Mr. WILLIAM SMITH (Bolton) said he had been interested in the remarks of the last speaker, because they had to be very careful at Bolton regarding the temperatures of the tar, and the selection of the tar. With regard to what had been said about vertical retorts and naphthalene, he thought they had had less at Bolton since adopting them. With regard to what Mr. Kendrick said about the comparisons for three years, and comparing one works with another for these periods, he did not think this was at all feasible, as varying quantities of naphthalene came forward through the difference in temperatures of the gas. It would not be quite fair to compare one works with another in that way.

Mr. F. V. BARNES (Todmorden), who also confessed to naphthalene troubles, said that if the heat of the condensers was not carefully watched, some of the naphthalene was taken out of the tar and carried forward. They had lately been adding creosote to their tar. At the same time they had altered the arrangements for the water supply and brought down the temperatures of the condensers considerably. This had helped them a great deal.

Mr. JOSEPH M'NICHOLL (Mossley) said he desired to suggest that the success of Mr. Simmonds's process was not due so much to the method of application, or to the solvent used, but to the fact that, instead of using a stream of gas as in the Maxim process of carburetting, he employed air, which, in his opinion, acted as a carrier for the solvent. When the gas was used it was quite possible that its composition was such that it was incapable of carrying forward any vapours or spray.

Mr. R. H. GARLICK (Salford), speaking from the distributing engineering side of the question, said that at Salford they had had naphthalene troubles to contend with, but had cured them to a large extent. They found certain material in the mains which their chemist had analyzed and said it was due to cyanides having some action on the mains and depositing certain material which dropped down and came into contact with an oily substance—something in the nature of treacle, but not quite so dense. Had the author had any troubles of this sort? They had in their district about 74,000 consumers and 10,000 lamps in an area of about 40 square miles, and were generally troubled with naphthalene during April and October. In 1914 they had only 172 complaints—quite a phenomenal year; and in 1915 they reduced this to 159.

Mr. ROBERT WATSON (Doncaster) said as one more or less concerned with naphthalene tronbles, and interested in palliatives, the discussion had proved most interesting to him, especially the reference to the trouble with the diaphragms of dry meters. As the author had had three years' continuous experience, he would like to know to what extent his dry meters had been affected. It seemed to him this proposition was going to be a serious one for the future—and a problem accentuated by the fact that they had adopted the "C" process for taking toluol out of the gas.

Mr. H. E. BLOOR (York) said he should like to ask whether it was quite fair to draw such a definite conclusion from such a short experience. The author had given them the figures regarding naphthalene stoppages under three different processes for the three years past—2162, 3428, and 1233. To him (the speaker) the figures did not seem to provide a sufficiently clear line of demarcation for them to say that the process before them was responsible for the alteration. Had the number of stoppages been 233 instead of 1233, or rather in tens instead of hundreds, it would have given them a more definite indication. As Mr. Tagg had said, there were no figures in the paper showing the number of complaints prior to the adoption of any means for preventing the naphthalene troubles. It would, therefore, be interesting to hear what these figures were, as he would like to be assured that the difficulties in 1915 were not accounted for by any other circumstances. With regard to toluol (this matter did not arise out of the paper), the speaker thought they ought to be in possession of some authoritative information before the summer as to whether they would be wise in washing by the "C" process. In his (the speaker's) opinion they would do no harm whether they went on attempting to extract the toluol; but it should be possible to get to know something really definite upon the subject. He hoped that inquiries would be made into the matter.

Mr. SAMUEL GLOVER (St. Helens) said he had been interested for a long time in the subject of naphthalene, its prevention where possible, and cure where it persisted in occurring and recurring. He thought he had been interested in the question ever since the investigations were published of Messrs. Botley, of Hastings, and the other authors to whom Mr. Simmonds alluded in his paper. The author had that afternoon also gone back to the work of the late Mr. William Young, who, along with himself, and at his suggestion, was the first to determine that to prevent stoppages in the distributing mains and services and lamps of a coal-gas works, it was necessary to associate with the gas the vapour of an oil of the same vapour tension as the naphthalene in the gas. This was, he thought, some little step in the direction of defining clearly the principle upon which it was necessary to act to overcome the naphthalene trouble, where it was present in such a quantity as was likely to lead to its deposition in the mains and services. He was rather afraid that, because some of these papers had not been sufficiently noticed and studied by the present generation of gas engineers, the subject had had to be brought before them again that day; and some of them had had to begin to study the subject as if no paper had been written on it before. They did, however, want to get down to the basic facts, and to do what Mr. Newbigging had said—stop naphthalene production. Then they would have taken the best means to get rid of the trouble, on the principle that prevention was better than cure. He did not want anyone to go away from the meeting disappointed that some members could do things at their works, by certain oils and certain methods, which they themselves could not, and feel that they had not realized any benefit from the meeting. Naphthalene in some of their areas had run a very long way from their works into the districts; and they could not turn on a tap one day at the works and hope that the trouble they had accumulated for many a day was going to be cured quickly. The author said he had tried many processes for the cure of naphthalene. He (the speaker) thought he said he had tried three processes; but his view was that he had only tried, in a measure, some processes in his own way for his own district. The 1913 plan was a method applied in one way; 1914 was another medium; and then he came forward in 1915 with a further process worked in another way. This time he applied the process at a point where it was more likely to tell directly on the district, because he was applying it into the main that was conveying the gas directly on to the district, and not, as he was in 1913 and 1914, into the inlet of the gasholder, where possibly considerable quantities of oil used were deposited, as shown by the action of the "Solvene" on the paint of the gasholder. He did not want to criticize Mr. Simmonds's process in any censorious way, as he felt he was looking for the truth, and would be willing to look at all sides of the question. With regard to Mr. Leather's remarks, he could not help but think that he had been speaking about the atomizing of petroleum. He (the speaker) could not imagine that any atomizing process could atomize so thoroughly as a vaporizing process. What was a vapour? It was a mist of atoms and of oil vaporized. A member had remarked that it was really "mysterious." Exactly so; but they wanted to do away with mysteries and get down to simple facts. Mr. Simmonds's statistics showed that in the year 1913 not much good was done by the application of "Solvene" in the washer. In that case the tar would run off, and the "Solvene" be absorbed in the tar, for the latter would, undoubtedly, absorb a very large portion of the former, and leave only the remainder to act upon the naphthalene. The best way for a complete mastery of the problem was perhaps to wash on the works in such a way as to prevent trouble in the works, and to vaporize on to the district along with the gas going out suitable quantities of suitable oils to prevent any trouble on the district. Talking about "mists," tobacco smoke when seen under the microscope was a mist of fine globules of moisture and vaporized smoke. A vaporizer on the whole atomized better in its application than any mechanical atomizer could possibly do. It struck him that Mr. Simmonds's quantity of naphthalene was not very high, but yet had not been able to remove the whole of it. He (the speaker) did not think the author would be willing to rest content until he had got rid of the trouble altogether. They looked forward to hearing from Mr. Simmonds later on that he had been able to evolve a method that would cure the varying complaints arising from naphthalene deposits. In regard to the question of dry meters being affected to some extent, the suggestion that chemists should turn their attention to this phase had been anticipated, and the meter makers themselves had taken the matter up. The Institution of Gas Engineers had also interested themselves in the matter, and in a short time they would hear more about it.

A MEMBER: When?

Mr. GLOVER said he could not say when. Mr. Bloor and others had expressed the anxiety in their minds as to toluol extraction during the summer. The Committee of the Ministry of Munitions last week had this matter before them; and he could tell them now, authoritatively, that the Munitions Committee were looking for the greatest help from gas engineers throughout the United Kingdom to produce toluol and benzol in as large a measure as possible, and hoped that they would secure for themselves now such control of matters in their works as would enable them to wash by tar all through the summer without the trouble that was experienced last summer. He particularly desired to emphasize the fact that the Munitions Committee were looking forward to all gas engineers to turn their skill in this direction.

Mr. J. H. BREARLEY (Longwood) asked whether members would be circularized to this effect by the proper authority.

Mr. GLOVER replied in the affirmative. He was only too glad to have been present that afternoon in order to let them know in the North what was required of them, so that they could get ready.

Mr. R. G. SHADBOLT (Grantham) addressed the members on the question of reducing temperatures in summer; but his remarks were hardly audible at the Press table.

The PRESIDENT intervened in the discussion at this stage, and said it must be concluded on account of another urgent question having to be brought before the members. Mr. Simmonds could not other than be gratified by the reception given to his paper, for it had led to a most interesting, if lengthy, discussion.

Mr. SIMMONDS, in the course of a brief reply to the questions, said the bulk of the gas made in the last three years had been with the De Brouwer machinery. For two or three months in the winter, however, they used the No. 2 retort-house, where the charging was by West's machinery, exactly under the same conditions as the De Brouwer, and with nearly full retorts. With regard to the figures of naphthalene stoppages, he had only given those for 1913, 1914, and 1915, because he thought they would be sufficient for the purpose. If he had quoted statistics showing what he had gone through during the eighteen years he had been at Bury, he was afraid he would have given them a very weary time. He thought no one had had more trouble than he had experienced. Last year (1915) was the best he had had since he had been at Bury for the smallness of naphthalene stoppages; and he merely showed the figures for the three years, so that members would see what the comparative results were. If he went back for (say) nine years, the average number of stoppages would be practically the same as those he had stated. At certain seasons of the year, they probably found a number of complaints coming together; but there was nothing unusual in this. With regard to Mr. Tagg's query, he could only point to the fact that the experience of 1915, when using naphtha in an atomizer, had certainly gone a long way to curing their troubles; and he thought that if he were to put a little more oil in, he could do away with complaints of naphthalene altogether. He whimsically declared that he would not like to be without complaints altogether; for complaints brought one into touch oftener with a consumer, and they might embrace the opportunity of supplying him with a gas fire or a cooker. He had not found any damage to the diaphragms of dry meters in his district. Another reason why he claimed that they were better this year than previous years, was that they were taking out of the gas 20 gallons of light oils per 100 tons of coal carbonized. As a matter of fact, they were not taking toluol out of the gas; they were putting it in. A question had been asked as to why he did not use steam instead of compressed air. He thought it would not be advisable to use steam, because this would increase the moisture in the gas, and moist gas had more tendency to deposit naphthalene than dry gas. It had afforded him much pleasure to fall in with the wishes of the retiring President to read a paper. He had contributed it more with the idea of giving them his own experiences than of telling them how to get rid of naphthalene. He thought the experiences he had had might possibly be useful to other members.

Gas-Power Driving in Textile Factories.

An engineering correspondent of the "Manchester Guardian," referring to the question of deciding upon the type of motive power to be adopted in building or re-powering textile mills in Lancashire, says this problem becomes increasingly difficult with each new improvement that is offered. After referring to the cost of running steam-power plants and electrically driven installations, the writer states that the probable cost of purchased electric current in the future is good subject-matter for speculation. It is, he says, unlikely that the low fuel prices of four or five years ago will ever return. Coal costs constitute an important item in electrical stations; and, if not quite so important in relation to total costs as many people imagine, it is beyond question that recent increases have caused power-station engineers grave anxiety, and have in many cases turned credit into debit balances. It is more than likely that purchasers of power-current will have to pay somewhat higher rates for a few years. On the other hand, we look forward in the near future to reductions through another channel. The extraction from coal of its valuable chemical products has been discussed for many years. Even at present coal prices, the value of these products may equal or exceed that of the raw fuel. Sooner or later their recovery will be universal. This is no idle theory. The possibilities are fully demonstrated in public electric supply stations run on blast-furnace and coke-oven gas on the North-East coast; on producer recovery gas (as at Accrington); and by similar procedure at numerous coal, iron, and chemical works in the country. The last eighteen months' experience has emphasized to scientific and commercial minds the folly of permitting present wastage of our most valuable national asset to continue; and a crusade has been inaugurated, with Professor W. A. Bone as chief expositor, to make the actual facts more widely known.

Suction Producers and Bituminous Coal.—An account was given of a suction-gas producer using bituminous coal by Mr. R. V. Farnham, at a recent meeting of the Institution of Engineers and Shipbuilders in Glasgow. He pointed out that, because of its low ash content, anthracite was chiefly used in suction and pressure gas producers up to 500-H.P. Coke was troublesome to gasify; and the calorific value was only 10,000 to 11,500 B.Th.U. per pound, compared with 14,500 B.Th.U. from anthracite. He considered the gas-engine for marine work would never succeed, if it depended only on non-bituminous coals; and he referred to experiments made on the "Farnham" type of engine and producer, which was designed to gasify ordinary bituminous coal, the cost of which was 13s. to 20s., against 30s. to 40s. per ton for anthracite.

FUNDAMENTAL PRINCIPLES OF GOOD LIGHTING.

This was the title of a paper by Mr. P. G. Nutting, read at the recent meeting of the National Commercial Gas Association of America—the eleventh annual convention held at Washington. The paper was a very long one; but the author did something to atone for this by saying that, in view of the "discursive treatment given to the subject," he had prepared a summary (as follows) of the various principles discussed.

The eye is our sole means of judging whether illumination is satisfactory or defective. The desirable properties of light sources, and of the field illuminated, depend upon the properties of the eye which is to view that field.

Lighting such as to produce a mean brightness level higher than 1 lambert* is excessive under all conditions. A brightness level under 0·1 millilambert is too low for the use of the eye for any purpose requiring discernment of detail.

With but moderate contrasts (20 : 1 or less) within the field of view, and work requiring no greater attention than reading, there is but little to choose between a mean field brightness of 1 and 100 millilamberts. For work requiring close attention, such as drafting or needle work, the most desirable brightness is about 10 millilamberts.

The greater the contrasts with the field or view, the higher (10 to 50 times) the mean level of brightness instinctively demanded by the eye.

There are four levels of brightness of chief interest to the illuminating engineer: Exteriors in daylight (mean level 1000 millilamberts); interiors in daylight (10 m.l.); interiors under artificial illumination (0·1 m.l.); out of doors at night 0·001 m.l. The instantaneous threshold and the retinal sensibility (threshold, contrast, and glare) are given for each level.

For interiors, no illuminant within the field of view should be brighter than 250 millilamberts, and no contrast should exceed 100 : 1.

Glossy furniture, dark furniture, and dark shadows are to be avoided, on account of the excessive contrasts which they are liable to introduce.

The distribution of brightness in an interior is preferably in the proportion of 100 at the ceiling to 30 to 40 at the eye level and 10 to 20 below the eye level.

Rapid alterations in brightness are not to be tolerated unless more rapid than 40 per second.

Quick changes in brightness over wide ranges are to be avoided. These may produce mere discomfort, temporary injury, or permanent injury to the eye.

The whole discussion has been an attempt to elucidate the principles of efficient lighting—efficient in the double sense of making the best possible use of the light and efficient in enabling the eye to operate under the most favourable conditions. Extremists have on the one hand tolerated any lighting that did not cause permanent injury to the eyes, and on the other have raised trivial objections to even minor causes of discomfort. The author has no sympathy with either view; what should be done in his opinion, and what is worth best consideration and effort, is the relief of over-worked and much-abused eyes from the wear and tear of the bad lighting conditions which have been put upon them. It would be unwise and unnecessary to relieve them of all discomfort at all times—that would surely result in a deterioration of the adaptability of the eye itself. The standard in his opinion should be the comfort of out-of-doors daylight lighting; abundant light well diffused and (by far the most important) but moderate contrasts anywhere. Under tolerable lighting conditions, the eye is wonderfully adaptable and efficient; and it is to be hoped that within the near future it will be relieved of the many trying conditions under which it is now called upon to operate.

* The lambert is the unit of brightness recently adopted by the Illuminating Engineering Society. It is the brightness of a perfectly diffusing surface radiating or reflecting one lumen per square centimetre. Brightness expressed in candles per square inch may be reduced to lamberts by multiplying by 0·4868. Brightness is, it is claimed, preferably expressed by lamberts not only because of the brevity of the name, but because of the apparent ambiguity of other terms in many cases. It is difficult, for example, to think of the brightness of the sky in actual candles per square inch.

Dutch Consumption of Coal-Tar Colours.—A Central Coal-Tar Colours Commission has been formed at Amsterdam, says the "Chemical Trade Journal," as a result of the recent decision of the German chemical-works to increase the prices of coal-tar dyes by 400 per cent. and only to accept payment in Dutch currency on the basis of the rate of exchange which prevailed in normal peace periods—namely, 100 florins for 170 German marks. It appears that the action of the German chemical companies was imposed by the German Government. At the recent meeting when the Colours Commission was constituted, about 100 representatives of consuming industries from all parts of the country were present. It was pointed out that Holland had hitherto depended almost entirely upon Germany for her deliveries of coal-tar colours, and that the new situation of affairs could not so remain. Most of the firms represented were inclined to pay the higher prices under protest, while at the same time it was agreed to ask the Government to adopt corresponding measures. The Commission were charged to collect data for submission to the Government in connection with suggested negotiations with the German Government.

COKE-OVEN MANAGERS' ASSOCIATION.

WAR PROBLEMS IN THE COKING INDUSTRY.

A Meeting of the Coke-Oven Managers' Association was held at the Department of Applied Science of Sheffield University, on Saturday evening, under the chairmanship of the PRESIDENT (Mr. George Chrisp), when a paper was read by Mr. G. STANLEY COOPER, B.Sc., on "Some Difficulties Due to the War; and Possibilities of Future Development."

The PRESIDENT, at the outset, congratulated those present upon the excellent attendance, in view of the wretched weather conditions (heavy snow). The thanks of the Association were particularly due to Mr. Stanley Cooper for having got the Council out of a difficulty in obtaining a reader of a paper for the meeting, by bringing his own paper forward by a month. This meant, of course, that he had been seriously handicapped in the hurried preparation of the paper; and if there should be found any little deficiencies, the reason would be understood.

Mr. G. STANLEY COOPER then read the following paper:

The original suggestion by the Council with regard to this paper was that it should deal with methods of using arsenical sulphuric acid in the manufacture of sulphate of ammonia; but I felt that, in spite of the importance of the subject, I could not make a full and satisfactory paper on this topic alone. Difficulties there have been in many directions; and I propose to deal only with some of those associated with the operation of bye-product coke-ovens, and not with the constructional side. Naturally, sulphuric acid looms largely in our minds at present; and I believe that the difficulty in this connection will get worse, instead of better. Arsenical B.O.V. is being largely supplied now to sulphate makers; and although the amount of arsenic does not generally exceed a maximum of 0·1 to 0·2 per cent., the effect of even this small quantity is very marked on the colour of the salt. I am not able to ascertain if it has any serious detrimental effect from the biological standpoint when arsenical sulphate is used as a manure; but I do believe that much unnecessary fuss is made of the arsenic question. We must, in the first instance, look to the manufacturer to take all possible precautions to reduce the arsenic to a minimum, as by careful control of the manufacturing process the arsenic certainly can be reduced. Flue dust from the burners at times contains an appreciable amount; while the mud deposited at the bottom of the Glover tower frequently contains much arsenic.

ELIMINATING ARSENIC FROM SULPHURIC ACID.

Many methods of removing arsenic from B.O.V. have been tried, with varying degrees of success; but the majority are inapplicable for coke-oven adaptation. The only method which offers any inducement to coke-oven people is the precipitation of the arsenic as sulphide, by means of sulphuretted hydrogen. This method also removes other impurities—such as lead, cadmium, &c. We have on coke-oven plants practically an unlimited supply of sulphuretted hydrogen; and this can be employed for the direct precipitation of arsenic. On a strong acid, however, the action is to produce sulphur, which is difficult to separate, and ultimately finds its way into the sulphate of ammonia.

On many direct recovery plants, it is a practice to allow a little tar to pass forward into the saturator. The arsenic is precipitated as sulphide; and the precipitate is collected by the tar and retained as a scum on the surface of the bath. The acid in store can be treated in a similar manner—bearing in mind, of course, that its strength must not be excessive. A good strong mother liquor, containing about 25 per cent. of free acid, and unsaturated with sulphate, can be fairly satisfactorily treated by H_2S. Where an ammonia still is in use, the effluent gases can be made use of to some extent, as they are rich in H_2S; and this method has the additional advantage that all the ammonia is recovered. The mother liquor needs to be in an enclosed vessel, provided with a gas inlet and outlet; and a sufficient quantity of thin tar should be added to form a layer about ½-inch in depth. It is also desirable to provide some means of running off the tar periodically. The efficiency of the method is shown by the results of some experiments carried out for me by Mr. G. E. Foxwell, of Sheffield. The tests were made on a saturated solution of sulphate of ammonia, to which had been added 10·9 per cent. of sulphuric acid; the acid being of 142° Twaddel, and containing 0·2 per cent. of arsenic. The solution of sulphate of ammonia, therefore, contained, in every 100 grams, 0·028 gram of arsenic. A portion of the solution was taken and covered with a layer of tar of about $\frac{3}{16}$ inch, and H_2S passed through for a considerable time. The tar was then separated; and the arsenic was estimated in both the liquor and the tar. The total sulphide equivalent of the arsenic taken was 0·036. In the tar was found 0·028, and in the liquor 0·003—there being a loss of 0·005 unaccounted for. This shows that the arsenic was reduced to about 8·5 per cent. of the original amount. As I am not making sulphate just now, I have not had the opportunity of instituting special trials. But I have found from previous trials that a considerable proportion of arsenic is eliminated; and this is the only practical method I am aware of by which it can be done.

SUBSTITUTION OF NITRE-CAKE.

Most of the members will have received a circular from the Ministry of Munitions concerning the substitution of sulphuric acid by nitre-cake in the manufacture of sulphate of ammonia. In connection with this and other matters of a similar nature, introduced by the Ministry of Munitions to coke-oven people, it is high time that this department had someone to advise it who really understands bye-product coking from the practical point of view, and who realizes what some of the fantastic propositions put forward occasionally really mean when applied on the works. The bye-product coking industry is one of the most important of the munition industries; yet, as far as I am aware, there is not a single practical coke-oven man on the staff of the Ministry of Munitions, and we are absolutely at the mercy of amateurs, theorists, and cranks whose sole qualification for the post they hold is an "open mind," which, at the same time, is absolutely ignorant of the real points at issue. We know how the Government have bungled things with regard to sulphate of ammonia.

The suggestion for using nitre-cake in the place of sulphuric acid is not new; but the Government tackle it from the wrong end first. You will have seen what the proposal means. They say that the sulphate produced by this method will contain 15·4 per cent. of sulphate of soda—thus reducing the ammonia content down to about 18 per cent.; while the free acid will be 1·4 per cent.! In the first place, What about bags with this acid content? Some years ago I experimented with nitre-cake for the same purpose; but I could never reduce the sulphate of soda down to anything like 15 per cent., and I do not think that in the hands of an ordinary sulphate man anything like this figure can be attained, or continuously maintained. The principal questions that arise are:

(1) Can the mixed sulphate be sold?
(2) How will the wear and tear of plant be affected?

The first of these questions is, presumably, ignored by the Government; and the second is very lightly passed over. To my mind, it is an open question whether it is better to adopt this method or to make as much sulphate as possible by the ordinary process, and waste the rest of the ammonia, or recover it in some other form. I do not think the process is at all suitable for either direct or semi-direct plants, as to work these with the liquor at boiling-point would be highly detrimental. On the other hand, if the temperature is below boiling-point, an excessive amount of sulphate of soda is deposited. The process certainly cannot be launched into general practice in the off-hand manner which the Government circular suggests. Again, you will probably have noticed that the men on whom this process is to be dumped are quite overlooked in the Committee appointed to discuss the question. I suppose we must suffer by their inexperience. But certainly, wherever possible, other methods of dealing with the ammonia should be adopted.

OTHER METHODS OF DEALING WITH AMMONIA.

The manufacture of nitrate of ammonia is out of the question, as nitric acid is more difficult to obtain than sulphuric. Ammonium chloride occurs in all ammoniacal liquor; and, although I would not in general advocate recovery of this, under present conditions it is well worth consideration. The production of crude ammonium chloride is comparatively simple; but the manufacture of pure salt is not easy under ordinary coke-oven conditions. The most attractive propositions are: (1) The manufacture of liquor ammonia, or pure ammonium hydrate; and (2) the manufacture of concentrated ammonia liquor. Of these, the latter is by far the simpler process. As an offshoot of the former, one firm has developed the manufacture of cloudy ammonia, used for washing purposes. For this, the liquor is distilled in the usual way, and the ammonia gas purified and absorbed in water to the required strength. The cloudy effect is usually obtained by the addition of soft soap. This process is, however, by no means as simple in practice as it looks on paper. The loss in manufacture is frequently high; the apparatus is somewhat complicated, and occasionally difficult to work efficiently; and the demand for the product is not unlimited.

Much more can be said on behalf of the manufacture of concentrated ammonia liquor containing about 15 per cent. of ammonia. In this case it is not always necessary to eliminate CO_2 and H_2S, though if these (and particularly the latter) are reduced, a higher price can be obtained for the liquor. The apparatus is not complicated; and the process itself is comparatively simple. The ordinary ammoniacal liquor is distilled; and the steam, ammonia, carbon dioxide, sulphuretted hydrogen, &c., are condensed by means of a water-cooled condenser. The amount of steam must be regulated in order to supply just sufficient condensed water to dissolve the ammonia, &c., and to maintain the strength of the condensed liquor at about 15 per cent. of ammonia. Concentrated liquor exerts a moderate pressure at ordinary temperatures; so that great precaution is necessary to avoid undue loss of ammonia. As the liquor runs into the storage tank, the displaced air will carry away with it some ammonia; and in order to prevent losing this, I connect-up the outlet pipe on the tank to the suction side of the exhauster. Any ammonia, therefore, passes again into the scrubbers.

The principal (and indeed the only) trouble usually experienced with this plant is the blocking-up of the condenser tubes by ammonium carbonate. In order to obtain a satisfactory effluent liquor, more steam has to be put into the still than is necessary to supply the amount of water required to form the concentrated liquor. A reflux condenser must therefore be employed, in order that the water content of the distillate can be regulated. With such reflux condenser the strength of the concentrated liquor can

be regulated as desired. As conditions are not always absolutely constant, the strength of the liquor will occasionally rise above 15 per cent.; and it is then that trouble with blocked pipes begins. With about 20 per cent. of ammonia, the liquor will solidify at ordinary temperatures; so that the condenser needs to be carefully watched at such times. Constant testing is, therefore, necessary in order to keep the liquor at the proper strength.

The way in which the ovens are worked with regard to suction has a very marked effect on the working of the concentrated liquor plant, which at first sight is not very apparent. With suction on the ovens, air is drawn in and carbon is burned. The amount of CO_2 in the gas is thereby considerably increased. This again results in the formation of more ammonium carbonate in the ultimate concentrated liquor; and the liability to blockage increases accordingly. By working our ovens at a rather higher pressure than usual, we have found that carbonate troubles have disappeared, as neither air nor flue gases are drawn in.

Many processes have been suggested for the partial elimination of CO_2 and H_2S; but the majority are unsuitable for ordinary practice, on account of unnecessarily complicating the apparatus. By preheating the liquor, partial elimination of both CO_2 and H_2S can be obtained; but at the same time some ammonia is also drawn off. To make it worth while, the liquor must be preheated to at least 95° C.

The following table shows the amounts of ammonia, carbon dioxide, and sulphuretted hydrogen eliminated at various temperatures with a particular liquor.

Composition of liquor:

Free ammonia	0·92 gm. per 100 c.c.
Carbon dioxide	0·86 ,, ,,
Sulphuretted hydrogen	0·122 ,, ,,

Quantities eliminated per 100 c.c. of liquor:

	Temperature.		
	85° C.	90° C.	95° C.
Ammonia	0·054	0·10	0·152
Carbon dioxide	0·158	0·16	0·304
Sulphuretted hydrogen	0·069	0·071	0·074

The same test carried out under a suction of 60 mm. of mercury gave the following results:

	Temperature.		
	85° C.	90° C.	95° C.
Ammonia	0·061	0 132	0·196
Carbon dioxide	0·184	0·203	0·378
Sulphuretted hydrogen	0·072	0·074	0·078

Disposal of Pitch.

The accumulation throughout the country of large quantities of pitch has caused a slump in this product, which has had a corresponding effect on the price realized for tar. The question of the carbonization of pitch in coke-ovens has been brought to notice as a possible means of reducing stocks, and of so helping to improve the outlook for tar. The proposal is that a proportion of pitch should be mixed with the coal before charging. The effect, it is said, would be to improve the quality of the coke, and also of the gas; while there is also the possibility of other advantages. The whole subject is at present under investigation; and I would urge those of you who are in a position to do so, to make a trial—using (say) 5 to 10 per cent. of hard pitch well mixed into the coal. Experiments, both on a small and a large scale, have been made; and the results are distinctly encouraging. You will, I think, all agree that if the position with regard to pitch can be eased at all, it will be a great benefit to tar producers.

Professor Bone and Technical Research.

In connection with this subject, it seems opportune to refer to the possibility of State co-operation in technical research. Professor Bone has frequently called attention to the urgent need for the establishment of a national bureau to deal with questions of fuel economy and allied matters. We can easily imagine that a great deal of good would result from such an establishment; and in the hands of the right men, it would prove to be an inestimable boon to the country. But we must have practical men—men who know the industry thoroughly, and who are fully aware of the nature of all the difficulties and problems we have to face.

Benzol Recovery.

One could not, under present circumstances, omit some reference to benzol recovery. Fortunately, I believe operation troubles are comparatively rare in this connection. But in some cases there has been a difficulty in obtaining supplies of suitable scrubbing oil. In my own case, by careful attention to the elimination of naphthalene from the oil, I have been able to prolong its working life very considerably. In view of the importance of benzol in the present crisis, it is rather surprising that we have not had some official guidance with regard to the best method of working our plants to produce the largest yield of benzol, &c. I do not propose in this paper to go into any great detail on this point; but I think the subject is one worthy of close attention, and I hope to stimulate some discussion on it. I consider the first step which the Ministry of Munitions ought to have taken was to appoint a Committee of practical men to investigate the question, and give us all the benefit of their investigations. They should tell us not only what to do, but how to do it.

I would like to revert for a moment to a topic which I previously introduced at one of our meetings—viz., the recovery of crude benzol of less than 65 per cent. In my opinion, it is little short of criminal at the present time to make 65 per cent. spirit; yet we are more or less tied to it by custom and convention. We know perfectly well that when the gas is scrubbed by creosote oil, &c., the latter extracts a variety of products. The general maximum temperature to which the oil is distilled for the recovery of these products is about 135° C. Now we also know quite well that the distillate so produced in the majority of cases is not 65 per cent. spirit, but something less than this. To make it into 65 per cent. spirit, we have to dephlegmate a portion of the vapours, which portion is run back into the scrubbing oil. The returned portion almost invariably contains both some benzene and some toluene; and I contend that we are doing wrong in not recovering it. We ought, in my opinion, to recover the whole of the distillate as produced; and we should get the same price for it as we do for crude benzol at present. If our usual buyers will not deal with it, the Government ought to make them. On every hand we are told that more benzol and toluol are required. The result of the adoption of this proposal will be a net increase in the toluene production of several per cent.

But the Government will not even deal with what benzol we have got, let alone take steps to deal with what might be recovered. For several weeks now I have carried a stock of over 10,000 gallons of benzol; and I am absolutely unable to get it moved. Our buyers blame the railway, and the railway blame the Government. Drastic action is required somewhere. When I applied for special labels for the conveyance of benzol, &c., I was told that no special labels were required, as tank-waggons were always given preference. As it takes over a week for my tar-tanks to travel about six miles down the line, one wonders where the preference comes in, and how long it takes to get ordinary traffic over the same distance.

I would like to press, therefore, the need for some concerted action on the part of the Association in these matters. What can we do to assist the production of an increased quantity of benzol? We can express our opinions as to the best conditions for its formation, and assist one another by giving our experience of our own working. Chemically speaking, benzol is a high-temperature product; and I have found that our yield is substantially increased when carbonizing at a high temperature. The naphthalene also is increased; but I do not think this is any detriment. I have heard the opinion expressed, on the other hand, that it is a distinct advantage. Working the ovens at a pressure of about 5 mm. in the collecting main, I have found to be most satisfactory. Suction on the ovens appears to me to be decidedly against a high yield of benzol. The effect of moisture is, I think, also slightly detrimental. In tests which I have carried out on the same class of coal, the best results were obtained from dry coal. At the same time, I would point out that it has been found that the illuminating value of coal gas is higher from wet coal than from dry; and it is urged, therefore, that the gas from the former is richer in benzol than that from the latter. If, therefore, in the subsequent discussion we can throw any light on the formation of benzol, we shall render a distinct service to the country.

Discussion.

The Chairman thought they would all agree that they had a paper before them which opened up unlimited possibilities for discussion.

Mr. E. M. Myers (Staffordshire) first of all voiced the indebtedness of the members generally to Mr. Cooper for his trouble in picking up and piecing together the threads for such a paper as he had given them. Personally, he (Mr. Myers) was particularly interested in the subject of pitch. He had tried experimenting—probably some eighteen months ago—with pitch, mixing it in proportion of 5 per cent., 7½ per cent., and 10 per cent. of coal. Although he did not intimately mix—that was, put the pitch into the disintegrator and mix it with the slack, as some people did—he must say he did not get very encouraging results. He found that when he rose to the height of 10 per cent. of pitch mixed with the slack, the moment the coal was charged into the ovens it was impossible for the men to get anywhere near the place to put the lids on. The great volumes of flame and smoke were tremendous; and as to its effect on the coke, he found no appreciable increase or decrease in the quantity of breeze to warrant him going to the trouble of mixing the pitch with the coke. He thought some means ought to be tried of mixing the pitch with small coke; and he believed a very good market might be found for the disposal of either briquettes or whatever they like to call them. He did not see why English railways—as had been done in Belgium—should not be forced by the Government to use patent fuel. He believed several people had gone wrong in trying to manufacture such fuel; but he did not see why it should not be found possible, by some means, to make it a marketable success. In any case, on his own works, the pitch difficulty was an alarming one. It required a tremendous amount of storage space and expenditure of labour to find a place suitable to keep the pitch out of the pitch beds, and so enable them to work their tar plants. He supposed all tar distillers had received the circular from the Ministry of Munitions, asking them to do this thing. He was looking forward to learning something as to how to do it. Another point to which he could not help referring (though he believed he had made mention of it on several previous occasions) was the question of ammonium chloride. In all coals to some extent, and in some coals particularly, ammonium chloride existed—in their case, as ammonium chloride. Why should they not recover it as

such, instead of distributing it as ammoniacal liquor? He thought this was a matter which should occupy some attention. As Mr. Lee had remarked on a previous occasion, the system which prepared and which recovered its products in the manner in which they were formed, without splitting them up, would succeed where other methods and systems which sought either to split up or add to their products, would not succeed. He did not see why it should not be the aim and object of everybody connected with the recovery of ammonia—and, as he had said, all coals gave off quantities of ammonium chloride in greater or lesser degree—why this salt, for which there was a ready market in some parts of the world, if not in this country, should not be recovered as it was? He would be glad of any information as to how to produce ammonium chloride in a marketable form, suitable for use either in this country or elsewhere.

Mr. COOPER said, with regard to the use of pitch, he found exactly what Mr. Myers had said was correct in reference to the smoke and flame. This was, to some extent, dependent on the condition of the pitch; and he found that intimate mixing had a lot to do with success in the matter. If it was intimately mixed, they did not get the flame and smoke up to quite the same degree. Of course, the quality of the pitch entered into the matter. It had to be an extremely hard pitch, which meant, of course, that the lighter constituents had already been removed. The matter of the men with whom they had to deal was a difficulty which they had to get over, and particularly at the present time. He had known a case of a man who thought he would have as near as possible a pitch coke, but unfortunately some of it ran out of the door. This was one of the troubles consequent on bad mixing. With an inferior coal, the quality of the coke was frequently improved. It must be so in either case. There might be special circumstances making difficulty; but he was convinced that there were possibilities in it. It was worth investigation. With regard to the recovery of ammonium chloride, he quite agreed with Mr. Myers. It was foolish to start with ammonium chloride, and then split it up into something else. On the other hand, this was the routine of progress. They always started at the wrong end first. With regard to the tar. Why condense it at all and redistil it? Why not take the fractions out? He thought that ultimately this would be done. The late Dr. Feld had a process for doing it, and he got some distillates quite as good as some of the distillates which were now being worked. They must bear in mind that because they happened to appear to be going wrong now, it did not follow that they would always go the wrong way. As they were situated at present, he did not think the recovery of ammonium chloride was "worth the candle." It was a question, after all, of "£ *s. d.*," with which they had to face their directors. If they achieved something which was a beautiful ideal, but which did not show a dividend, they did not get much sympathy. In the majority of cases, as they were situated at present, the recovery of ammonium chloride direct was not the most satisfactory way of dealing with it. At any rate, however, it was far preferable to dealing with nitre cake.

Mr. J. W. LEE: Might I ask if the pitch question is worked on the same basis of "£ *s. d.*"?

Mr. COOPER: Yes. To my mind the improvement you get out of it is not worth bothering with except from the "£ *s. d.*" standpoint. It has to be purely on such a basis, and unless the pitch question is sound from this point of view, I do not think it is worth bothering with at all.

Mr. LEE: That was my question. Is it sound? Reckoning pitch at what?

Mr. COOPER said at 10s. a ton. It depended very largely on local circumstances. They could work it out for themselves for what they could get the pitch at their works at, and what it was going to cost to handle it. There was a possibility in just coking pitch alone if they were going to get satisfactory coke.

Mr. LEE suggested that it was on very few works that it was satisfactory from the point of view of "£ *s. d.*"

The PRESIDENT said he had had it rammed-down his throat—and he thought they all had—that this was a matter of patriotic requirement, rather than one of money. Personally, he did not think it was satisfactory from the money point of view.

Mr. C. P. FINN said it seemed to him the Ministry of Munitions had, from a national point of view, made a false step in urging the use of pitch. He should have thought they were more concerned in the carbonizing of as much coal as possible, and the recovery of as much benzol as possible. Supposing they took 10 per cent. as the proportionate substitution of pitch for coal, if they were charging 300 tons of coal per day, that was 30 tons of coal substituted by pitch. They did not get the equivalent of crude benzol per ton of coal, and they were not really helping the Ministry of Munitions in producing an article which was badly wanted. He sympathized with Mr. Cooper when he said they ought to get the same price for 60 per cent. benzol as for 65 per cent.; but when they saw in the United States such prices as $6 per gallon were being paid for crude and $3 and $4 for benzol, they began to think they were being a bit hardly done by in this country. With regard to the question of sulphate of ammonia, and effecting economies in the use of acid by substituting nitre cake. He supposed anybody who had a benzol rectification plant to deal with would be using the waste acid for benzol washing. He was doing so. He might say that the use of the acid caused a marked improvement in the appearance of the sulphate produced. It was whiter and cleaner in appearance; and the men themselves, if one said to them: "That looks a bit darker than it has been," would reply: "We have not had as much of that dirty acid lately." He supposed it was an old dodge—it might be an exaggeration—that some old tar makers in the neighbourhood of plants used to buy acid tar for the purpose of making cleaner sulphate. With regard to nitre cake, he had been making sulphate of ammonia from nitre cake for about the past two months. Some time in December last a friend of his in another line of business asked him if he could help him to get nitre gas in some other form than using sulphuric acid. On his (Mr. Finn's) advice this gentleman substituted nitre cake for sulphuric acid; and at his place it was working quite satisfactorily, while his competitors in the same line of business were still declaring that it was impossible to use nitre cake. Naturally, in making sulphate of ammonia, his own method had been to make a bath up to 60° or 64° Twaddel. They found now that if they added 28 lbs. of nitre cake per bath immediately they finished blowing salt, they brought the liquor to about 74° Twaddel—10° higher than before. It brought the percentage of free acid to about the same, and made a salt containing about 24·6 per cent. of ammonia. The amount of free acid named in the Ministry of Munitions circular must, he thought, have been a mistake. The amount in his own was 0·19 per cent. of free acid. With regard to moisture, he would like to get it down; but he had never succeeded in getting below a little under 3 per cent. He would welcome any information as to how it was that this sulphate of ammonia had 3 per cent. of moisture in it. It appeared to be quite dry, and it would look as though the moisture was in the way of crystallization somewhere. He had not tried to make sulphate of ammonia with a lower percentage, because he had not been able to find any buyers. The Ministry of Munitions said no doubt it would be possible to find buyers; but he thought it was the business of the Ministry of Munitions to help producers to find people who would buy sulphate containing less than 24½ per cent. of ammonia.

Mr. G. W. BRADLEY said he would like to mention one interesting point theoretically on the pitch burning question. On a theoretical basis, it would seem impossible that they could obtain any valuable hydrocarbons by using pitch; so that by diluting the coal with the pitch, they were displacing the coal from the ovens. In regard to sulphate of ammonia, there was a very small percentage in the sulphate; and it should surely have a beneficial effect rather than otherwise. And certainly they could expect the arsenic in the sulphate to help in the present agricultural needs. In regard to nitro-sulphate in the nitre cake, agricultural people had told him that the land would not stand much salt; so it would seem that it would not stand much sulphate.

Mr. COOPER was afraid he was not sufficiently well versed in agriculture to be able to express an opinion on this point. He certainly thought that the arsenic question would not go very far. What they wanted to go back to was the idea of State research. The Government were dinning these things into them; and if they took the opportunity of putting some definite argument before people, they might do some good. The Government had a Department of Agriculture, and it was for this department to take some action and find out what was wanted. But, as Mr. Finn had said, and he himself had emphasized, the Government were beginning at the wrong end. If they would find some customers, the producers could make the sulphate of ammonia. The most important point in regard to use of nitre cake was what proportion of sulphuric acid to put in. If it was a few pounds of nitre cake in such a quantity that they only produced their ammonia salt—on a dry basis, he assumed—with 3 per cent. of moisture, to yield 24·6 per cent., he did not think it was worth tackling.

Mr. C. H. OXLEY, touching on the remarks of Mr. Finn in regard to moisture in sulphate, said he had very little experience of the semi-direct process; but he found on the wet system the sulphate produced contained about 3⅛ per cent. of moisture. He did not know if it was common with the semi-direct or not; but try as he would, he did not seem able to get it below 3⅛ per cent., and he had to dry it artificially.

Mr. COOPER said the question of moisture he was rather at a loss to understand, because he had never had any trouble in this connection. He had had the artificial drying; but he had had no trouble, with the salt once dried, in picking up moisture. He believed if their acid rose above 0·5 or 0·6 per cent., they would have some trouble.

Mr. MYERS said the question of moisture had bothered him at one time. His sulphate was not tested periodically, as ought to be done. They got parcels of sulphate going away with something like 3⅛ or 4 per cent. of moisture in it. He simply found that the sulphate men were not whizzing it properly. They had a lot of work on hand; and it was a case of the men scamping their work. By simply whizzing the salt properly, they now never got above about 2 per cent. of moisture.

Mr. W. B. WILSON HAIGH said the only trouble he had had in regard to moisture was the blowing in of waste or exhaust steam from other sources.

Mr. G. A. LANT said in the Government circular they spoke of utilizing the nitre cake. It said, "Use two parts of nitrate water to three parts of chamber acid." This was all right for those who happened to be near an acid works; but how were the others to get the acid into the works? It would eat through iron tanks. The chamber acid also was full of arsenic. If they were going to use nitre cake and arsenical chamber acid, it was going to be a pretty funny sulphate of ammonia when everything was finished. In regard to the paragraph in the paper "Other Methods of Dealing with Ammonia," he should like to know what Mr. Cooper con-

sidered the most profitable to work to recover—the 15 per cent. or the 25 per cent. solution?

Mr. COOPER said the Government would pay them more for 25 per cent. solution than for 15 per cent.; but when they had made 25 per cent. for about five minutes, they would be glad to go back to the 15 per cent. With the 25 per cent., they very soon got the whole of the apparatus blocked-up solid. He found that, with his liquor, almost the instant they got about 17 per cent., they did not know where they were for five minutes together. The usual custom with regard to payment was by a sliding-scale, taking the basis of 15 per cent. The blockage he mentioned sometimes necessitated a fairly long stoppage; and these stoppages had a habit of happening just when the storage tank was full. Thus, though they might have provision in the way of duplicate apparatus, he had sometimes had to shut-down the whole plant. From the point of view of the man who had to work the salt, there was not much doubt as to which was the best to work. To return to the question of strength of liquor, 15 per cent. was a good figure at his own plant, for the reason that they had at present only one storage tank. They had been experiencing very cold weather lately, and had been having requests for stronger liquor, and he found that the whole of his storage tank, at 17 per cent. strength, was absolutely solid, with the prevailing atmospheric temperature.

Mr. HAIGH said that whenever he got an extra amount of arsenic in his acid—which, fortunately, was not often—the men began to complain. It made them ill. He did not know whether anybody had ever tried to treat the acid by passing the saturator gases through the acid in some way, outside the saturator. He had had no experience, but had been hoping to have heard something in regard to this—either lead-lined tanks or otherwise. With regard to the pitch problem, he thought they were perhaps making a great deal about the coke output. After all, the Ministry of Munitions wanted coke as well as other things; and he (Mr. Haigh) thought that they were not working at full speed on many plants simply because they were not getting enough coal.

Mr. COOPER considered it quite a practical suggestion that he had put forward in the paper. He had done it outside the saturator by making use of the mother liquor plant and running the acid down to 144° Twaddel into the liquor tank. Regard it, if they liked, as an extra acid tank; but it must be lead-lined. It was away from the saturator, and he brought in other crude gases, diluted, if necessary, with distilled gases, straight into the tank.

The PRESIDENT was entirely in agreement with Mr. Cooper in his statement that the Government should consult practical men. He had to say that in this connection the Council of the Association had already protested in very strong terms against some of the advisers who had been sent to the industry. The question of the use of nitre cake to him was not a very feasible one—for this reason: Some of them might consider that he was biased, because he had a sulphuric acid plant under his charge. But if they considered how much nitre cake would be necessary in the production of sulphate of ammonia in the amounts the Government required—assuming the three parts of chamber acid to the representative two parts of B.O.V.—it meant that they would want nearly 10 cwt. of acid qualities in the nitre cake. Compare this with what the sulphuric acid could do. He thought that, notwithstanding the large stocks of nitre cake up and down the country, inside a month the whole stock would be wiped out. As a fact, 100 tons of sulphate would produce less than a ton of nitre cake, which only showed how impracticable were some of the schemes put forth. With regard to the arsenical sulphuric acid, again perhaps he was a bit biased. There was not, in his opinion, a great deal of chance of their getting much non-arsenical acid. The ores from which it was made came from Norway and Sweden; and, apart from international difficulties, there was now a big strike on there. The majority of the ores coming here now were from Spain; and these were highly arsenical. The chamber acid was not so arsenical as the ordinary B.O.V. they bought. If they could get chamber acid at 110° Twaddel, it was fairly free from arsenic; but it was the acid the Government were wanting to-day. It was he considered within the means of any member to have a little dearsenicator plant of his own if he wished. It was simple; but the trouble was filtering afterwards. The means for dearsenicating were quite simple. With regard to the using of pitch, there was a suggestion from one of their own associate members (Mr. Taylor) that they could experiment with non-coking coal—adding pitch to it; and he (the President) hoped in the course of a few weeks to carry out some experiments in this direction and have something to report to the Association later.

Mr. FINN: Do I understand you to say you base the amount of nitre cake available in this country on the amount of sulphuric acid produced?

The PRESIDENT: Yes, practically.

Mr. FINN said this was not quite correct, of course, though he admitted that the bulk of the nitre cake was produced in the sulphuric acid plant. It was, however, also produced in the nitric acid plant.

The PRESIDENT: That is quite true. His statement, of course, should be corrected to this extent; but they knew that the quantity of nitric acid made was almost negligible as compared with the sulphuric acid.

Mr. J. T. PRICE (Hon. Secretary), referring to the President's remarks as to dearsenating acid, said he himself had carried out some small experiments. He had had various sorts of acid, and he had, as a result, put down a small experimental dearsenicating plant. He had not used the H_2S mentioned by Mr. Chrisp. He was sure the suggestion of putting down a small dearsenicating plant was quite a feasible one.

Mr. J. W. LEE moved a hearty vote of thanks to Mr. Cooper, and said as they were now in the special war stress they were doubly indebted to a man who spent a few moments of his leisure in giving the members the benefit of his experience.

Mr. E. M. MYERS, seconding the vote of thanks, said personally he thought it was a most valuable paper which Mr. Cooper had given; and if they secured papers of this calibre throughout their existence, they would have amply justified the formation of the Association.

The proposition was carried unanimously, with acclamation.

Mr. COOPER, in a brief reply, said he had intended to put before them one or two amplifications of experimental work which he had in hand in connection with the subjects to which reference had been made—especially the use of nitre cake.

The Formation of Local Branches.

The meeting then proceeded to consider a motion, of which notice had been given previously by Mr. E. M. Myers, on behalf of the North Staffordshire members, as follows: "That sections be formed in different areas of the country, the formation of such sections to be sanctioned by the Association, and each section to have one representative on the Council of the Central Association. Such increase in the numbers of the Council, caused by the election of district representatives, shall be sanctioned *ad lib.*, until the whole of the areas of the country have been apportioned to respective branches."

Mr. MYERS said he had put the arguments in favour of this proposal pretty fully at a previous meeting. He had hoped to have had Mr. Hollingworth, of Birchinwood, to second the motion; but that gentleman was unavoidably absent. The Staffordshire members had been asked to formulate a scheme; and at a meeting which they had had, it had been agreed that it would be far better for the formation of any scheme to be left in the hands of the Council of the Association, if the Association decided to have these branches. They in North Staffordshire, as he had mentioned at a previous meeting, had from time to time met among themselves to discuss problems of the industry—technical, commercial, and labour—long before the Association was formed; and when the Association was formed, the Staffordshire men had practically joined in a body. The men at a distance from the Sheffield centre, however, were under present conditions something in the nature of passive resisters. Fully half the members, he believed, were in the position of being unable, in the present stress of work, to get to any meetings or take any active part in the Association and its very important work. That was why the Staffordshire men had formulated this idea of area sections or branches. They were not prepared to determine the staking-out of the country; this would be better done by the Council. Even if it was rather early in the history of the Association to make such a change, he thought all would agree that it would be beneficial to the Association and to the industry; and it was highly important, of course, that the proposed branches should have direct representatives on the Council of the Central Association. The people in Staffordshire, Durham, and Cumberland, and in Wales, were at present paying their subscriptions more or less merely for the sake of patriotism to the industry; but at the same time the Association would be much healthier if workers were absorbed from all parts of the coke world in this country. Therefore he hoped the meeting would give the Association the power to establish these branches. He did not necessarily say that the whole of the country should be apportioned out immediately, with the power to add their representatives to the Council. All honour was due to those who had, in the Sheffield district, floated the Association into being, and worked it up; and there was no desire to prevent them from continuing the work of furthering the Association and the industry. All the outside men wanted was to be able to help.

The HON. SECRETARY (Mr. J. T. Price) seconded the proposition. He said he had done a certain amount of work in the formation of the Association, and had come in contact with many of the members. Going through the list, he found that they had 89 members—including honorary members and associates. Durham and Cumberland contributed 14; Staffordshire, 10; South Wales, 5. The remainder were in the Yorkshire areas or on the borders; but some of these in Yorkshire in these busy times were at distances which prevented their attendance at Sheffield meetings. It was high time something was done for these members in the outside areas. As a matter of fact, a number of the members in Durham and Cumberland and in South Wales had drawn his attention to this need; and he had had several letters to this effect. He really believed that the matter must be tackled very shortly, or they might be losing some of the members living long distances away. He thought the branches could be formed at once. The Council, he believed, were unanimous on the point. He thought that they should consider the formation of the Association somewhat on the lines of the Institution of Gas Engineers—governed by a Central Executive, on which would be representatives of the branches. It was all right these distant men having the honour of belonging to the Association; but they wanted, and were entitled to, something more for their money than the advance copies of the papers, which could be read in the Technical Press without being members. He believed, indeed, the existing system

of the Association was keeping out some men who would otherwise be members.

The CHAIRMAN read a telegram from Mr. Hollingworth, regretting his unavoidable absence, and hoping the meeting would adopt the formation of branches. The President said he was cordially in agreement with the proposal, and he believed the Council were also. The original idea when the Association was started, had been to form a Sheffield Association; but it had developed so rapidly that it had become a national thing. Branches ought certainly to be formed and representatives sent to the Council.

Mr. HAIGH said he took it that the resolution would not alter the existing rules.

Mr. MYERS replied that part of the original motion had been left out deliberately, so that the rules need not be altered.

The PRESIDENT said under the proposed scheme the Council would consist naturally of more than five members.

Mr. J. W. LEE said he was entirely in agreement with the idea; but he asked if it would not be better for the Association to have a definite scheme before it, before voting on the matter. He was convinced that such a system was the eventual outcome for the Association; but it would be better for the Council to have consultation with special representatives of the areas before submitting a scheme for final acceptance by the members. They had as yet no idea how large or how small the areas were to be. He might say, in answer to the reference to the Institution of Gas Engineers, that this organization had no branches. It was one association, and meetings were held in different parts of the country wherever the President for the year happened to live and work. Actually what happened was that there were District and Junior Associations.

The PRESIDENT said the Council had already several schemes under consideration; and if the meeting passed the resolution authorizing the Association to proceed with the idea, the Council would probably present a scheme at the next general meeting.

Mr. PRICE said he had not meant that they should copy exactly the Institution of Gas Engineers. He simply meant that they should base their idea on the Central Association lines of the Institution, and have the annual meetings of the Association at different centres on their lines. He had communicated with Durham and Cumberland and South Wales, in regard to their sending a representative to consult with the Council; but all the gentlemen who had written suggested that a circular direct from headquarters would meet with better success than any action taken by them individually in their areas.

Mr. HAIGH said if all they were asked to do that evening was to sanction the principle of the formation of branches, he thought they were all in agreement. He was quite with Mr. Lee in regard to excepting details as yet.

Mr. MYERS said the only detail the motion possessed was that of the appointment of representatives on the Council. Without this detail the idea was worthless.

The motion was then put and carried unanimously.

HAVE VERTICAL RETORTS MADE GOOD?

From an American Point of View.

The "American Gaslight Journal" for Feb. 14 contains an article on this subject, by Mr. R. N. Buell, some parts of which will interest English readers.

He wrote: To the gas company contemplating the construction of new, or the enlarging of its present coal-gas plant, no greater problem presents itself than the question as to the type of bench to be installed—Shall it be "horizontals," "inclines," or "verticals?" The author will not be so presumptuous as to offer an opinion as to which system is best; but by placing before readers comparative data, gleaned from reliable sources, the present status of the various styles of coal-gas benches may be more readily understood.

Beginning from the time of Murdoch with cast-iron retorts set in horizontal benches, with very shallow furnaces, the construction of coal-gas benches, for a period of fifty years or more, underwent little change; the improvements being very gradual and limited. The principal innovations during this time were the adoption of fire-clay retorts of various shapes, in place of cast-iron ones; and the introduction of the regenerative or recuperative furnace, by means of which a larger firebox capacity was available, and the use of properly-heated secondary air mixed with the producer gases in the combustion chamber, furnished a much higher degree of heat than was hitherto obtainable. A few other minor changes had also been made—such as the substitution of the lever self-sealing mouthpiece lid for the lime-luted screw lid, and the introduction of water, steam, and air under the furnace grate-bars to minimize the collection of clinker in the fire-box.

Trials had also been made, in a limited way, with benches of through retorts; and power charging and discharging machines had begun to appear upon the market. During the latter part of the Nineteenth Century various experiments were made with the inclined type of gas-bench, which was a distinct innovation, and caused the old conservative gas makers to make forecasts of its ultimate failure. They contended that the charge of coal would clog the retorts, making it impossible to withdraw the coke; that the temperature inside the retorts could not be properly controlled; and that the weight of the retorts would displace the lower outside wall. These calamities, however, failed to materialize; and the wise ones admitted that the inclines had come to stay. Many authorities claim that the inclined system to-day, with the many improvements recently added, is the best type of bench for plants making from one to two millions per day.

While the horizontal and inclined benches were contending for the honours of greatest efficiency, suddenly the vertical system loomed above the horizon and claimed a hearing. For the past few years verticals of continuous and of intermittent types have made great strides in popularity and efficiency. The plans and specifications of the systems have undergone many changes since their introduction, both in line and dimension, and silica retorts and settings, in place of fire-clay, are now the general usage.

In America, the adoption of the vertical system has been confined to the Eastern States and Canada. But the Western and Middle West States are studying the situation; and if ultimate results bear out the claims made by their promoters, the next few years may witness the installation of many new vertical plants.

Various problems enter into the selection of a system; but the question generally narrows itself down to one of economy. Which system can deliver marketable gas into the holders at the least cost? Of course, there may be various local conditions that influence the final decision. For instance, if ground area is limited, the vertical system has a distinct advantage.

To determine the relative operating conditions, and the results obtained by the three leading types of coal carbonizing plants using retorts, the writer has obtained authentic data from some of the largest and most successful gas-works in America. The statistics are from three well-known plants—*i.e.*, the Laclede Gaslight Company of St. Louis, using the horizontal-through system; the Springfield Gaslight Company of Springfield, Mass., using the inclined system; and the Ottawa Gas Company, Canada, using Glover-West verticals. No doubt the average gas man will find food for thought in the tabulated statistics. It may be taken as an accepted fact that the abnormal yield of gas per pound of coal carbonized obtained by the Ottawa plant could never be successfully maintained in the States, where the standard of B.Th.U. calls for much richer gas.

One pertinent inquiry that may arise in the minds of some who read this article is this: If gas of 535 B.Th.U. calorific value is satisfactory to Canadian consumers, why would not a gas of equal value pass muster in the United States? This and similar questions which the discussion of the subject may have suggested, the writer leaves to those more capable than is he to answer—believing that the army of experts giving serious thought to the advancement of the manufacture of artificial gas will eventually produce now undreamed-of issues, and sure to result in credit to the industry, and to the benefit of the public at large.

—	St. Louis.	Springfield.	Ottawa.
Type of bench	Horizontal	Inclined	Vertical
Date of installation	1913	1905	1915
Number of benches	16	5	6
Number of retorts per bench	8	9	8
Dimensions of retorts	16 inch by 26 inch by 16 feet	15 inch by 23 inch by 18 feet	8½ in. by 2 ft. 9 in. Top 1 ft. 6½ in. by 3 ft. 3 in. Bottom 20 ft. 3½ in. Long
Coal capacity of retorts per foot	81 lbs.	60 lbs.	100 lbs.
Average gas yield per pound of coal carbonized	5·75 cubic feet	5·00 cubic feet	6·389 cubic feet *
Average fuel consumption, per cent.	13½ to 15	15	15
Candle power of gas	16·5	16	—
Calorific value, B.Th.U.	620	610	535
Duration of charge	8 hours	6 hours	Continuous—Coal passes through in 10 hours
Method of charging	De Brouwer machine	Gravity	Gravity
Composition of retorts	Silica	Fire-clay	Fire-clay †
Ammonia recovered per ton of coal carbonized	5·75 lbs.	5 lbs.	4·5 lbs.
Tar recovered per ton of coal carbonized	12 gallons	15 gallons	12 to 14 gallons
Cost of retort-house labour per ton of coal carbonized	27¾ cents ‡	—	—
Scurfing periods	14 days	6 weeks	18 days

* The apparent high yield obtained in Ottawa may be accounted for by two things: First, the automatic coal-scales were found to vary 5 per cent.; and, second, in cooling the coke, a jet of live steam is passed into the coke-chambers, producing water gas, thus increasing the yield and decreasing the B.Th.U. of the gas.

† Combustion chambers lined with silica.

‡ Does not include superintendence or exhauster attendance, but includes cost of handling coal from cars to bins, and coke to outside receiving bins.

PRODUCTION OF AMMONIA FROM CYANAMIDE.

The text is now available of a paper by Mr. W. S. Landis, of the American Cyanamide Company, presented at the eighth annual meeting of the American Institute of Chemical Engineers, held at Baltimore on Jan. 12.

Introduction.

After working for many years on the problem of the fixation of atmospheric nitrogen in the form of cyanides and cyanamides, the outbreak of the Boer War forced Professors Frank and Caro, of Berlin, to turn their attention to the utilization of their products otherwise than in the field of precious metal extraction. A consequence of the then existing economic situation was the discovery of the process of transforming the cyanamide compounds into ammonia. United States Patent No. 776,314, granted Nov. 29, 1904, most probably represents the first American publication on this subject.

According to the specifications of this patent, various cyanamide compounds and derivatives—including the crude form of the calcium salt, sold under the name of lime nitrogen—when treated with steam or water in the proportion of three molecules of water to two atoms of the nitrogen in the cyanamide salt, will yield ammonia. It is recommended in the specification that the reaction be carried out at temperatures from 160° to 180° C., in a closed vessel, though the claims of this patent cover temperatures above 100° C.

There has grown around this process and its later refinements in the last fifteen years an extremely important ammonia industry. Naturally, the greatest development has been in Europe, its home; and it is only within the past year that a plant comprising full-sized apparatus has been in operation in the United States. In attempting to catalogue the various plants throughout the world which have been converting cyanamide into ammonia in large-scale operations, I find that available information—particularly since the outbreak of the European War—is so incomplete that the listing in consequence was very inaccurate. It is certain, however, that the transformation of cyanamide into ammonia is successfully carried out in Norway, Germany, France, Switzerland, Italy, and Japan, and, prior to the war, in Belgium—the bulk of the product going into ammonium sulphate for the chemical and fertilizer trade. Norway is producing large quantities of ammonia used in the Birkeland-Eyde plants for the production of ammonium nitrate; France has produced considerable quantities of anhydrous ammonia by this process; at the present time Germany is producing enormous quantities of nitric acid from this cyanamide-ammonia by a newly developed oxidation process, and is erecting cyanamide plants fully equipped with ammonia apparatus at various places.

The fixation of atmospheric nitrogen—chiefly due to our Government's policy in respect to water-power development—has not been practised in the United States. During the year 1914 contracts were let in Germany by the American Cyanamide Company for the equipment of the largest single ammonia plant then projected or operating in the cyanamide industry; but the outbreak of the European War interfered with the shipment of the apparatus, nearly all of which was seized by the German Government for the purpose of providing for its own explosive requirements. It was possible to bring only a small portion of the equipment over to the States, where it was set up and put into operation, and is now producing several tons of pure ammonia gas per day. This plant has been in continuous operation here for six months without any signs of trouble whatever, and is considered to be most successful and satisfactory in every way.

Raw Materials.

The crude cyanamide or lime nitrogen is now a well-known commercial product. The Canadian factory supplying the United States and its insular possessions with this product has a capacity of fixing nitrogen equivalent to 90,000 lbs. of ammonia per day, and with the completion of certain additions now being made will be capable of supplying some 110,000 lbs. of ammonia each twenty-four hours. The demands for this product (most of which goes into the fertilizer industry) are so great that the plant is now operating at its full rated capacity. It is, therefore, evident that the supply of raw material for an ammonia industry is in no sense limited.

Crude cyanamide or lime nitrogen, the reagent used for the production of ammonia, is an electric furnace product. As turned out of the furnace it contains nearly 25 per cent. of nitrogen in the form of $CaCN_2$, 12 per cent. of CaO, and 12 per cent. of carbon, with miscellaneous impurities derived from the various raw materials entering into its manufacture.

The other raw materials entering into the ammonia process are soda ash and hydrated lime. The quantities used are small—being approximately 3·5 and 2 per cent. respectively of the weight of lime nitrogen used. Steam and power requirements, which vary with the size of the plant, are discussed later.

Chemistry.

On treating lime nitrogen with steam, ammonia is produced from the calcium cyanamide, according to the reaction:

$$CaCN_2 + 3H_2O = CaCO_3 + 2NH_3.$$

The reaction is almost quantitative when carried out on a large scale according to the process to be described later in detail. This reaction is exothermic in character; and while the exact heat of formation of calcium cyanamide has never been determined accurately, it is believed that the heat evolution from the decomposition of the cyanamide alone amounts to between 200 lbs. and 300 lbs. cals. per pound of ammonia evolved. This plays an important part in the present method of carrying out the process, inasmuch as after once starting the reaction under proper conditions it will proceed of itself—in fact, with such great velocity that only complicated and highly-developed apparatus can take care of the gaseous products.

The process as carried out in the plant operating in the United States is essentially that described in the specifications of United States Patent No. 1,149,633, dated Aug. 10, 1915, "Process of Making Ammonia from Calcium Cyanamide."

In order to take advantage of the exothermic character of the reaction, as above stated, the process is made to take place in an autoclave partly under high pressure. This apparatus consists of a steel tank approximately 6 feet in diameter, 21 feet high, and capable of operating under a working pressure of 300 lbs. per square inch. It is provided with a powerful stirring apparatus. Into the autoclave is charged about 12,000 lbs. of mother liquor derived from a previous operation (fresh water to start); and lime nitrogen is slowly fed into this liquor under continuous agitation. As the lime nitrogen contains always a fraction of 1 per cent. of undecomposed carbide, acetylene is evolved during this dissolving of the lime nitrogen. A proper ventilating system is provided to remove the acetylene at such dilutions as will be non-explosive even if subjected to a source of ignition. The charging is usually carried on over a period of an hour, so as to ensure thorough incorporation of the lime nitrogen with the solution and the breaking-up of all lumps in the slurry. When the lime nitrogen has all been added to the autoclave, the reagents (soda and lime) are added for the purpose of increasing the efficiency of the ammonia evolution, principally through the prevention of the formation of polymeric forms of cyanamide compounds, which are difficult of transformation into ammonia.

The autoclave is then closed and steam is admitted for approximately 15 minutes, or until the pressure gauge on the autoclave registers 3 or 4 atmospheres, which indicates that the temperature in the autoclave has been raised sufficiently to start the reaction at a fair rate of speed. The reation then proceeds of itself—generating ammonia and steam in the autoclave; and it is necessary to relieve this gas accumulation, by means of suitable valves, so as to avoid excessive pressures in the apparatus. The rate of reaction becomes cumulative as the temperature rises; and this relief of ammonia and steam must be permitted. Under normal working conditions the pressure in the autoclave will rise to about 12 to 15 atmospheres in the course of about twenty minutes, with the relief-valve open. The pressure then drops off slowly, as the gas is discharged; the rate of discharge being usually regulated by the attendant at the valve so as to maintain a constant pressure in the ammonia line, and at the end of about one-and-a-half hours from the start of the operation the evolution has usually stopped.

Nearly all the cyanamide in the charge has been decomposed during the first period of this operation; but the solution is still highly charged with ammonia, which it is necessary to expel. A very small amount of undecomposed lime nitrogen may be left—particularly of polymerized forms, which yield up ammonia only slowly. The steaming operation is then repeated, this time introducing steam until the pressure of the autoclave goes up to 6 to 8 atmospheres. The ammonia discharge valves are again opened until the autoclave is discharged, requiring a period averaging approximately half-an-hour for this second discharge. In order to ensure practically complete evolution of all the ammonia in the autoclave, it is advisable to again repeat the steaming to 6 to 8 atmospheres for a third period—discharging as before. During this last period of steaming and discharge rarely more than 2 per cent. of the total ammonia as charged is evolved; and it can, therefore, be omitted if extraordinary demands on the capacity of the apparatus are made.

Extended studies of the course of this decomposition of lime nitrogen in the autoclave have been made both abroad and in this country, and are here reproduced in the form of charts. The discharge from the autoclave consists of a mixture of steam and

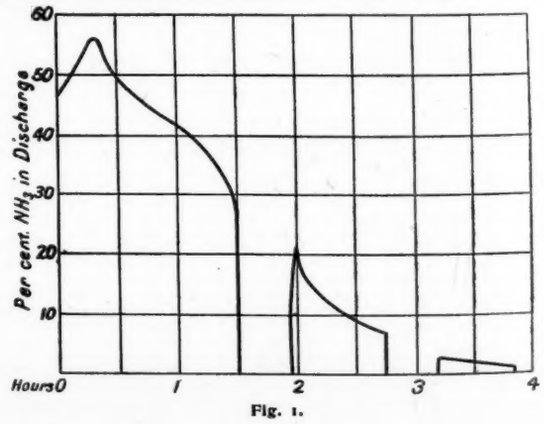


Fig. 1.

ammonia, the composition gradually changing during the cycle. This variation in composition is shown for an actual operation carried out in this country in fig. 1, in which the ordinates represent the percentage of NH_3 by weight in the ammonia-steam mixture discharged from the autoclaves, and the abscissa the time after start of the operation—analyses of the discharge being made at approximately three-minute intervals.

The rate at which ammonia is discharged from the autoclave under operating conditions varies with the imposed condition. It has been found that most requirements are met by discharging at such rate as to maintain a constant pressure of steam and ammonia in the main leading from the autoclave. Under such conditions the rates of discharge during a given operating cycle are

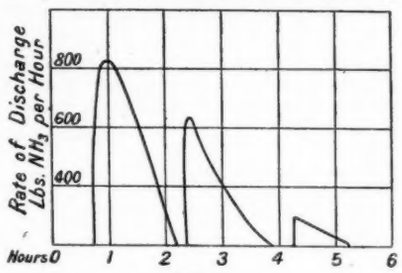


Fig. 2.

represented by the curve in fig. 2, in which the ordinates are the pounds of ammonia discharged per hour, and the abscissa again the various elapsed times from the start. In this case the charge in the autoclave was 7000 lbs. of lime nitrogen analyzing about 26 per cent. equivalent NH_3.

Where a uniform supply of ammonia is required, it can be obtained by the insertion of a special type of gasholder in the system. Also suitable grouping of a number of autoclaves and their cylindrical operation will assist greatly in obtaining a uniform rate of production without the use of such gasholder.

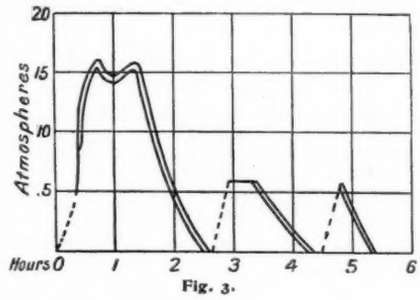


Fig. 3.

In fig. 3 is shown a curve of the pressures existing in a European autoclave, slightly smaller than the one described above, and operating on a charge of 8000 lbs. of lime nitrogen. The dotted lines represent the admission of steam, and the full lines the pressures as shown on the gauge on the autoclave. The ammonia discharge valves of the autoclaves are opened where the lines are indicated double.

At the close of the operation, the bottom discharge valve is opened, and the mud contained therein runs by gravity into large suction filters of the "Nutsche" type. Here the liquor is sucked-off from the solid constituents; a thorough wash with water is given; and the sludge removed to the dump. Under normal operating conditions this sludge when dried contains less than 0·2 per cent. of equivalent ammonia, and about 65 per cent. of CaO in the forms of carbonate and hydrate. It is dark grey or black in colour, due to the carbon present, and finds application as an agricultural lime. The liquor removed from the filter is used in dissolving the next batch.

Handling the Gas.

In the manufacture of ammonium sulphate, as carried out extensively abroad, the mixture of steam and ammonia coming from the autoclave is led directly into an absorber and produces a high-grade white sulphate. This production of sulphate is much simpler than from ammonia liquor. Where the introduction of the accompanying steam is not permissible—as in the production of certain ammonia salts which cannot be subjected to high temperatures, or where the process involves subsequent evaporation and crystallization—the ammonia-steam mixture coming from the autoclave is passed through a simple rectifying column provided with a dephlegmator and condenser, and there is obtained therefrom a practically chemically pure ammonia gas, saturated with moisture at the temperature of the condensing water. This rectifying column is self-acting, because of the large quantity of steam admitted with the ammonia-steam mixture. It requires no attention whatever in its operation, other than to shut off the cooling water to the condenser when not in use.

The ammonia derived from the column, as before mentioned, is practically chemically pure, and is used directly in a large number of chemical industries. The Birkeland-Eyde engineers absorb this ammonia gas in distilled water, forming a dilute aqua ammonia, which they add directly to their dilute nitric acid for the manufacture of ammonium nitrate—the product being of extraordinary quality. On the other hand, ammonium nitrate of equal grade may be produced directly from the ammonia gases dehydrated in the column without the water absorption step.

One of the large autoclave plants in France has been manufacturing anhydrous ammonia for years; and in addition to the above purification system they have installed an oil-washer, charcoal filter, and lime drying boxes before liquefaction. The oil-washer, the writer was informed, was installed to remove some very minute traces of an unknown organic compound; but he has inferred that the character and quantity of this impurity, from the manipulation of the apparatus, is largely mythical.

For the production of nitric acid from ammonia, the product as taken from the condensers attached to the ammonia column is so pure that no trouble is occasioned by the poisoning of the catalyzers used in its subsequent oxidation.

Efficiency of Decomposition.

An extended study made by the writer a year ago of one of the European plants which had been in operation for a long time, showed that the transformation efficiency of the nitrogen in the lime nitrogen into ammonia was over 99 per cent. Our American plant is showing operating efficiencies, covering a period of several months, substantially equal to the above.

Autoclave Plant.

An economical autoclave unit is one of eight working shells. As the operating load factor on these autoclaves is very close to 100 per cent., it is not necessary to supply more than one spare shell to this eight-autoclave equipment to ensure a full 100 per cent. load factor. Such a plant of eight autoclaves would require a 300 H.P. boiler. It was the old practice abroad to set the safety valve on the autoclave shells at twenty atmospheres and operate the boiler at this pressure. In our own designs here in the States, we have successfully operated at 125 lbs. steam pressure without trouble, and can take steam from a common plant main. Superheated steam is preferable for the purpose, but not absolutely necessary. There are in addition required for operating the lime nitrogen feeding device, the stirrers in the autoclaves, the vacuum pump and the air compressor, and miscellaneous sludge disposal equipment, a continuous motor load of approximately 100 H.P. (the connected motor load would probably average about 200 H.P., depending upon local conditions).

Operating Costs.

In the compilation of a cost-sheet for the production of ammonia from lime nitrogen, there is such great latitude in unit costs concerned that the writer is presenting rather full quantitative data, to which he is appending assumed unit costs. In most cases the assumed unit costs are averages existing before the outbreak of the European War; but to these an approximate return may be expected after its close. In any case they may be readily corrected to meet local conditions.

Lime nitrogen (*26 per cent. ammonia*) is unquestionably the cheapest source of nitrogen (ammonia) in this country. The sale prices are dependent to an extent upon the quantities and deliveries contracted for. The freight is allowed at $3 per ton of lime nitrogen shipped in special containers, which should cover the greater portion of territory in the United States lying within a 500-mile haulage radius of Niagara.

Caustic lime is to be air-slaked on spot, 2 per cent. weight of lime nitrogen assumed at $6 per ton delivered.

Soda Ash. 3·5 per cent. of weight of lime nitrogen at $16 per ton delivered.

Power. 100 H.P. continuous at 1 c. per H.P. hour.

Steam at 30 c. per 1000 lbs., 60 per cent. weight lime nitrogen.

Water. 2 U.S. gallons per lb. of ammonia. As the larger part of this is used in condensers and coolers, the greater proportion may be salt water. Assumed at 2 c. per 1000 gallons.

Labour and Superintendence. Assumed at 300 men-hours per day at 30 c. per man-hour.

Repairs and Renewals. $1·50 per ton of ammonia—a record of long time operations.

Interest. Assumed at 6 per cent. on plant cost of $120,000.

Depreciation. On plant cost of $120,000 depreciated in ten years—say, 8 per cent.

Operating Cost of Ammonia Plant.

Capacity, 30,000 lbs. of Ammonia per Day.

Gas Saturated with Water at Cooling Water Temperatures.

Item.	Quantity.	Rate.	Per Day.	Per Lb. Ammonia.
		Dols.	Dols.	Dols.
Freight	—	3·00	180·00	0·00600
Lime	1·20 tons	6·00	7·20	0·00024
Soda	2·10 ,,	16·00	33·60	0·00112
Power	2400 h.p. hr.	0·01	24·00	0·00080
Steam	72,000 lbs.	0·30	21·60	0·00072
Water	60,000 gallons	0·02	1·20	0·00004
Labour	300 men-hours	0·30	90·00	0·00300
Repairs and renewals.	..	..	22·50	0·00075
Interest	..	..	20·00	0·00067
Depreciation	..	..	26·66	0·00089
Miscellaneous	..	..	24·67	0·00082
Total conversion cost (excluding NH_3 losses)			451·43	0·01505

Cost of Plant.

On account of the varied building conditions existing through

the country, it is almost impossible to give a detailed estimate of the cost of plant. A recent projection of such costs made by this Company for a plant of this size—from which I have deducted the cost of land, foundations, and sludge disposal—shows that an ammonia plant of the size described could be erected for about $120,000. This plant is designed to produce as its final product an ammonia gas cooled to the temperature of the available water of the condensers, and, therefore, not strictly anhydrous. This figure further assumes that water and power are furnished to the plant, and no provision is made for power or pumping plants.

Steel buildings with corrugated iron sides and roof, and of a type which have demonstrated themselves as fairly satisfactory for this service, are included. The limitations imposed by building laws, and choice of architecture, may force one to materially modify this estimate, as cheaper forms of construction may be used. On the other hand, many may prefer a more elaborate type of building than that provided in the above estimate, which would materially raise this figure.

SUMMARY.

The large number of installations operating with perfect success in various parts of the world for a number of years have demonstrated the commercial possibility of making ammonia from lime nitrogen. The plant in its present highly developed state is extremely certain in its action and simple to operate. The efficiency obtained in the transformation of the nitrogen in lime nitrogen into ammonia gas is upwards of 98 per cent., or almost quantitative. The consumption of reagents is remarkably small; and they are cheap and easy to obtain in almost all parts of the world.

The quality of the ammonia produced by the process is not surpassed by any in the United States. It is chemically pure as produced, and requires no further costly and tedious purification to render it available for the highest-grade chemical products, or for the production of liquefied anhydrous product. The actual cost of production of this high-grade pure ammonia on a considerable scale, which enables one to take advantage of the lower prices at which lime nitrogen is offered, brings high-grade cyanamide-ammonia into the market almost as cheaply as the more impure forms already found there, and very much cheaper than it is possible to obtain an equal quality of ammonia from gas-house liquor, coke-ovens, &c.

The Fuel Question at the End of the War.

Dr. P. W. Uhlmann, now resident at San Paulo, has communicated, in a long article in the "Chemiker Zeitung," his views on the way in which the fuel question will be taken up after the war is over. In their own interests, all large consumers of coal will, he thinks, make the change to gas-making with recovery of bye-products. Large central stations will be established for the production of gas and electricity, at the pit's-mouth in the case of coal, and close to lignite and peat deposits. The State will insist on the economical use of fuel, and encourage manufacturers to adopt plant for consuming it on rational lines. Maximum charges will be fixed for gas and electricity, and spheres of employment allotted to each—subject to one works being able to assist the other in case of any interruption of operation. The adoption of such a system will, according to Dr. Uhlmann, afford the following advantages: Economy of fuel, especially through a far more extended use of coke; recovery of bye-products; opening-up of peat-bogs, and consequent extension of agriculture; saving of labour in industry, and consequent liberation of labour for agriculture; cheapening of work in industry and agriculture; and improvement in the means of competition in the world's markets.

Road Board and Tar Treatment.—Supplementing the statement made in the "JOURNAL" for the 15th inst., that the Secretary of the Institution of Gas Engineers had received an official intimation that the Treasury had sanctioned a similar grant this year to the Road Board to that made last year, it may be mentioned that the Board have now informed county authorities that the Treasury have authorized them to make grants and loans of £200,000 for surface tarring, pitch grouting, and tar macadam. This, the Board add, is in view of the desire of the Ministry of Munitions to encourage the use of refined tar, so as to maintain the supply of distillation products for high explosives, and also to protect important roads from disintegration.

Advocating the Calorific Standard.—The Secretary of the National Commercial Gas Association of America has been instructed to ask all the State and District Associations to present to their members for approval a resolution which was passed at the Washington Convention of the Association, earnestly recommending the adoption of the heating basis in rating the value of gas. The reasons set forth in the resolution are the almost universal adoption of the incandescent system, the great and increasing demand for gas for industrial and domestic purposes other than illumination, and the fact that the leading authorities, after making exhaustive and impartial examinations, have concluded that the heating value is the proper basis of rating of gas quality, "which conclusion is emphasized by recent State Commission rules having specified that the rating of gas quality shall be based on the heating value of the gas."

THE CARBONIZATION OF PITCH.

Some Data by Mr. Tim Duxbury, of Oldham.

At Saturday's meeting of the Manchester District Institution of Gas Engineers, Mr. TIM DUXBURY (the Engineer of the Oldham Corporation Gas-Works) referred to the question of "Carbonization of Pitch," a subject which has aroused great interest in the profession. It had been intended that the proceedings should take the shape of an informal discussion upon the whole matter; but owing to the heavy programme gone through during the afternoon, there was little time for more than hurried reference to the subject.

Mr. DUXBURY, who was received with cordiality in recognition of the work he has done in investigating the question, gave the following statistics on coal and pitch mixtures, and hard pitch.

January, 1916.

EXPERIMENTAL PLANT CARBONIZING 24 CWT. OF COAL PER DAY.

COAL AND ORDINARY PITCH MIXTURES.

—	Coal Neat.	5 per Cent. Pitch.	10 per Cent. Pitch.
Coal carbonized . . . . . cwt.	40	40	40
Pitch carbonized . . . . . ,,	0	2	4
Total . . . . . ,,	40	42	44
Total gas made . . . . . cub. ft.	27,130	27,020	27,050
Gas made per ton of coal only, uncorrected . . . . . cub. ft.	13,565	13,510	13,525
Gas made per ton of coal, corrected to 60° Fahr. . . . . cub. ft.	13,090	13,085	13,095
Calorific value of gas—gross B.Th.U. on calorgraph	581	594	625
Candle power, ½ hour bookings on jet .	16·20	16·73	17·38
Corrected gas made per ton of coal and cub. feet calculated to 540 B.Th.U. gross	14,090	14,400	15,170
Coke per ton of coal only . . . lbs.	1,668	1,743	1,808
Tar per ton of coal only . . . gallons	12·0	15·5	17·75
Quality of coke	Good	Good	Good
Quality of tar	—	—	—

Coal used, Hemsworth washed nuts, all from the same waggon.
Heats higher when using pitch coke.
Make per ton calculated on coal only, not including pitch.
Ordinary pitch used, not specially hard pitch.

THE RESULTS OBTAINED.

Five per cent., or 1 cwt., of pitch per ton of coal carbonized gave an increased yield of 310 cubic feet of gas per ton of coal, 75 lbs. of coke, and 3½ gallons of tar. This is equivalent to 6200 cubic feet of gas, 1500 lbs. of coke, and 70 gallons of tar per ton of pitch. Taking gas at 10d. per 1000 cubic feet, coke at 15s. per ton, and tar at 20s. per ton, the figures give a value of 22s. 2d. per ton of pitch. The calorific value of the gas was increased from 581 B.Th.U. to 594 B.Th.U., and the candle power from 16·20 to 16·73. The coke was improved; the heats being higher after using pitch each test. Similar comparative results were obtained by carbonizing 10 per cent. of pitch. The above yield per ton was calculated on coal only, not coal *plus* pitch. The tar analysis is not yet completed; but the specific gravity was slightly higher. The tar also contains more naphthalene.

COAL AND HARD PITCH MIXTURES ON EXPERIMENTAL PLANT.

—	Coal Neat.	Coal *Plus* 5 per Cent. Pitch.	Coal *Plus* 10 per Cent. Pitch.
Coal carbonized . . . . . cwt.	20	20	20
Hard pitch carbonized . . . . ,,	0	1	2
Total . . . . . ,,	20	21	22
Total gas made . . . . . cub. ft.	14,490	14,810	14,950
Gas made per ton of coal only, uncorrected . . . . . cub. ft.	14,490	14,810	14,950
Gas made per ton of coal, corrected to 60° Fahr. . . . . cub. ft.	14,120	14,240	14,710
Calorific value of gas gross—B.Th.U. on calorgraph	531	552	551
Candle power on jet taken every ½ hour .	14·96	15·23	15·83
Corrected gas made per ton of coal and calculated to 540 B.Th.U. . . . gross	13,880	14,556	15,010
Coke per ton of coal . . . . . lbs.	1,657	1,717	1,780
Tar per ton of coal . . . . gallons	11½	15½	17
Quality of coke	Good	Good	Good

Coal used, Hemsworth washed nuts, all from same waggon for these three tests.
Heats higher when using pitch.
Make per ton calculated on coal only, not including pitch.

OLDHAM CORPORATION GAS-WORKS LABORATORY REPORT.

Feb. 16, 1916.

Examination of Tar from Coal Treated with 10 *Per Cent. of Hard Pitch and from Untreated Coal.*

Coal used, Hemsworth washed nuts, both samples from one and the same waggon.

Tested 1 ton of coal in each case on experimental plant.

Took 2000 c.c. of tar, and distilled up to 300° C.

—	Untreated.	Treated.	Remarks.
Gas made corrected to 540 B.Th.U. . . . cub. ft.	13,880	15,020	..
Tar made . . . gallons	11½	17	..
Water content in tar, per cent.	4·3	3·6	..
Naphthalene, &c., ditto. .	13·25	17·5	By volume
Toluol per ton of tar, gallons	2·460	2·040	Corrected for paraffins and to 5 per cent. water content
Toluol per ton of coal, gallons	0·141	0·173	Corrected for paraffins and to 5 per cent. water content
Pitch by weight, per cent. .	69·62 Hard and dull	71·80 Softer and Brighter	..

One little difficulty they experienced in stacking pitch was that they could not carry it to any great height. At first, they decided to stack it 10 or 15 feet high; and they left a 2 feet passage down each side of the wall and in the centre. But in less than a month all the pitch came together—so much so that it was nearly pushing the wall of the building into the adjoining canal. This necessitated cutting a road on the canal side. He merely mentioned it as one of the troubles in dealing with the question. Briefly, the proposal was to carbonize pitch, and to take it off the market to a large extent; and it was his experience that the more coal they carbonized admixed with pitch, the more toluol they recovered. The increase at Oldham in toluol recovery by this treatment was 0·032 gallon for every 2 cwt. of pitch; and he was of opinion that whatever increase of toluol they got came from the pitch alone.

Mr. SAMUEL GLOVER (St. Helens) said the suggestion of the carbonization of a percentage of pitch in gas-works was a way by which the tar maker could control to some extent the value he shall ultimately receive for his tar, inasmuch as if he helped to remove to some degree the incubus of the increasing stock of pitch held by tar distillers in this country, he was in a measure avoiding the still further drop in the prices of tar which would surely come about if pitch could not be removed into a new market for the time being. Let each engineer find out what percentage he could use—from 2½ to 5 per cent.—of the pitch he could get delivered at his works, either from his own tar distiller or from some other source. A comparison of prices between coal at the present day, and pitch at the price to which it had descended, made this proposal quite a practical one.

Mr. H. KENDRICK (Stretford) congratulated Mr. Duxbury on his excellent figures, and said he had been greatly interested in those published in the "JOURNAL OF GAS LIGHTING" from Mr. Thomas Glover, of Norwich, and also those of Mr. Alex. Yuill, of Dundee. He desired to emphasize the importance of the statements made in the "JOURNAL OF GAS LIGHTING" for Feb. 22 [*ante*, p. 402], with which he cordially agreed. The most promising outlook for restricting the accumulation of pitch was to use it admixed with coal for gas making; for at the present prices it would undoubtedly pay to carbonize pitch, as the latter commodity could be delivered at less than coal prices. As yet, however, the profitableness did not appear to be very substantial. The greatest advantage seemed to lie in preventing the pitch market being laid in ruins for a considerable time. The following figures showed results achieved at Stretford for the seven weeks commencing Jan. 12 last; the quantity of pitch used being 142 tons, or 4·7 per cent. of the coal carbonized.

	With Pitch.		Without Pitch.
Gas made per ton (corrected), cubic feet .	12,292	..	12,393
Illuminating power.	14·59	..	15·10
Calorific value, gross B.Th.U.	511·6	..	523·0
Temperature average, Fahr.	40°	..	46°

[The figures showing the results without pitch are those taken for the seven weeks immediately preceding.]

These figures were not in any way "tests," but simply actual working results. They tried various admixtures of pitch, ranging from 3 to 7 per cent. With a 7 per cent. admixture, they found trouble with the ascension-pipes and hydraulic mains; so they dropped back again to 3 per cent., and gradually worked up to nearly 5 per cent. At the present time, they were using 5 per cent. of pitch admixture. The figures were complicated a little by varying circumstances; for at one portion of the time they were washing with heavy oil owing to naphthalene troubles. But the last seven weeks had been with tar. The temperatures were also different. Their own tests (which had yet to be confirmed at the laboratory) showed that more toluol was yielded during the last two months than in the preceding two months; so that the process was distinctly advantageous from this point of view.

The PRESIDENT (Mr. E. A. Harman) said that when Mr. Duxbury's figures were published members would doubtless take the opportunity of going more closely into this interesting matter.

ABSORPTION OF OXYGEN IN GAS ANALYSIS.

In a recent number of the "Berichte of the German Chemical Society," Herr Heinrich reported on the absorption of oxygen in alkaline solutions and on a new absorbent for oxygen. He has observed that a hydrosulphite solution prepared with solution of caustic soda, which has been recommended by Franzen for the absorption of oxygen, absorbs that gas much more slowly than a hydrosulphite solution prepared with a solution of caustic potash. For instance, the soda hydrosulphite solution took nine minutes to absorb the oxygen from 50 c.c. of air, whereas the same quantity of hydrosulphite, mixed with an equivalent quantity of caustic potash, effected the absorption of the oxygen in three minutes. It is thus advantageous, in using hydrosulphite as an absorbent, to prepare the solution with potassium hydroxide instead of with sodium hydroxide.

A similar difference in the action of potash and soda solution was found in the use of alkaline pyrogallol for absorbing oxygen. Various observers have shown that the rate of absorption of oxygen in alkaline solutions of pyrogallol depends to a large extent on their concentration; but the solutions of a concentration which will give the best absorption are not applicable in technical gas analysis, because they evolve carbonic oxide when applied to neat or slightly diluted oxide.

Herr Heinrich has found that oxyhydrochinone is a rapid absorbent of oxygen, which retains its efficieney for a long time. He produced the solution by preparing triacetyloxydrochinone according to Thiele's method from chinone, and boiling with concentrated solution of caustic potash. The solution thus obtained may be directly used for gas analysis without the necessity of first producing the oxyhydrochinone in the solid form. The solution absorbs oxygen very energetically; 100 c.c. of pure oxygen being completely absorbed in one to two minutes without a trace of carbonic oxide being produced. It is immaterial whether this absorbent is prepared with caustic potash or caustic soda.

New Stoking Machinery at York.

At the annual meeting of the York Gas Company, Mr. Alfred Procter, in moving the adoption of the report and accounts, said they had been seriously hampered in the disposal of residuals; and the restriction in public lighting and shop lighting had caused a substantial loss of revenue from the sale of gas. At the last meeting, it was intimated that the Board had adopted a scheme prepared by Mr. H. E. Bloor (the Secretary and Manager) for mechanical stoking and coke handling. The machinery had now been partially installed. The amount spent upon it during the year was £7613; and they confidently anticipated better results in working and considerable economy. Owing to labour shortage, it was not possible to maintain certain parts of the plant in efficient working condition in November; and the output had of necessity to be restricted for a few days. The fire at the works in the autumn was traced to a fault in a portion of the plant, which was not quite finished. The whole of the damaged apparatus had been replaced with modern plant of the highest efficiency. The necessary provision had been made for the extraction of toluol. This did not tend to improve the quality of the gas; but they were still able to maintain it above the statutory standard. Forty of the staff had enlisted; and during the year £715 had been expended in allowances. Notwithstanding restrictions and difficulties, the volume of business had increased during the year; and they were able to report an advance of 10¼ million cubic feet in the gas sold. The rise in the cost of manufacture of gas was £6324. It would have been much higher, but for forward contracts on favourable terms—a position which had enabled them to pay their way with the comparatively small increase of 2d. per 1000 cubic feet. Sales of gas realized £2861 more, and residuals £2384 more. The balance of profits amounted to £14,699, which was less by the sum of £440. They were only £998 short of the sum required for dividend; but the undivided profits amounted to £12,450, out of which it was proposed to take the money. The Board had come to the conclusion that it was necessary to make a further increase of 4d. per 1000 cubic feet in the price of gas. This would involve another reduction of dividend, and would fall with particular hardship on the Company, as it was only in 1912 that Parliament fixed the standard price and dividend. They were carefully considering whether action could be usefully taken towards obtaining relief. A dividend at the rate of 4 per cent. per annum was agreed to.

Satisfactory Working at Weymouth.—That the working in the manufacturing department had been very satisfactory was the report the Directors were able to make to the proprietors of the Weymouth Consumers' Gas Company at the half-yearly meeting last Thursday. It seems that, as the result of a general overhaul of the plant and the adoption of improved methods of carbonizing, there has been a large saving of coal, through the yield of gas per ton being much greater. The sale of gas during the six months ended Dec. 31 was only slightly less than it was in the second half of the year 1914; the quantity sent out being 78,290,800 cubic feet, which was a decrease of 250,400 cubic feet, or 0·31 per cent. For the whole year, the quantity sold was 154,321,900 cubic feet, which exceeded the sale for 1914 by 6,503,000 cubic feet, or 4·39 per cent. An increase which was made in the price of gas of 6d. per 1000 cubic feet produced an amount which practically met the additional cost of coal. There were other increases, in wages and materials; but these were more than covered by the unusually good returns from residuals. There was a balance available of £7320; and out of this the Directors recommended the payment of a dividend on the ordinary stock for the half year at the maximum rate of 5 per cent. per annum, less income-tax.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Mr. Bradfield's Comparative Working Results.

SIR,—I very much regret to inform you that an error was made in my analysis [pp. 408-9]. The amount shown in the Gas Light and Coke Company's figures, as realized per butt of ammoniacal liquor—viz., 5s. 9·04d.—should have been 8s. 4·36d. This, of course, would mean a corresponding increase in the same item of the second table, from 3·79d. to 2s. 11·11d.

Would you kindly put a paragraph in your next issue in as conspicuous a position as possible acknowledging and correcting my error.

Commercial Gas Company, Feb. 25, 1916. F. J. BRADFIELD.

Showroom Reform.

SIR,—May I be allowed, through your columns, to express my appreciation of the interest taken by your readers in my recent article on "Self Help for Showroom Attendants." This interest, I may say, is manifest, not only in the letters which have been addressed to, and published by, the "JOURNAL"—and to which I now propose to reply—but also in numerous private communications, all of a distinctly encouraging nature.

I think it must have been clear to every one that my remarks in themselves, as well as the mere fact that they were ever penned, were a full recognition of the important service which an aspiring showroom attendant is in a position to render to gas and the undertaking he is employed by—always provided he is given, or is able to assume, some degree of initiative.

As to remuneration, it must be admitted that gas salesmen are not as a class overpaid. But I have endeavoured to suggest that showroom experience should be regarded rather as a means to an end than an end in itself; and looked at in this light, the position of the showroom attendant is probably no worse than that of men engaged in any other sphere of activity, and in process of laying, by practical service, a solid foundation for future progress. It would, perhaps, be useless to make any kind of appeal to the man who gauges his opportunities by the salary he is, for the time being, taking. The man is, or should be, of greater consequence than his job; and if observation serves me rightly, the only way any worker can demonstrate his fitness for promotion is to prove by his present efforts that he has a genuine claim to a higher salary than the figure he hopes to improve upon. Again, one has to take commercial conditions as one finds them; and I am afraid that the man who is always looking for encouragement is not likely to go far in the race. At the same time, I have every sympathy with the gas salesman in his desire to elevate his status; and I do not think it would be possible to evince that sympathy more sincerely than by pointing out to him the splendid opportunities which the nature of his work provides. The status of any class of workers is, after all, but the measure of their own average merit; and a gradual improvement of the latter correspondingly elevates the former.

I should like to add that, in my opinion, many responsible authorities show an indifferent regard for their own interests and those of gas by treating the position of showroom salesman as one which anybody can fill, and that it would be to the advantage of all concerned if due circumspection were exercised in selecting the showroom staff, which, when all is said and done, is often the only commercial link between an undertaking and its consumers.

CYRIL G. DAVIS.

60, *Oxford Street, W., Feb.* 25, 1916.

SIR,—In your issue of the 8th inst., I notice that Mr. Cyril G. Davis has taken up the cudgels on behalf of the showroom attendants and their ethereal attainments. It is a subject that many have endeavoured to fathom in the past; but as salesmen we are still awaiting a fair breeze to waft us along into the elysian realms of success.

Our diplomatic efforts to create an impression that we are highly paid is rather against Mr. Davis's maxim—viz., "Be honest in your statements;" and it might end to the detriment of our pockets. The whole secret lies in making the position worthy of the man. The present recruits do not add lustre to the department; but capabilities are not the qualifications nowadays, as there are too many hereditary appointments. Our department has been a "blind alley" up to the present, and a reform is necessary.

Whether Mr. Davis's parables will bear the fruitage of success, depends solely upon the treatment meted out to shrowroom attendants in the future. Money is necessary for self-respecting, honourable maintenance; and if one requires the wisdom of a seer, one cannot expect to obtain it for a mere pittance. The majority of the salesmen have eaten of the tree of knowledge; but their power is very limited, and in several cases they are treated on a par with the labourers. Our voices have been crying in a wilderness, and we are subjected to petty tyranny, that even our souls are not our own.

We now place our claims in the scales of justice, trusting that our appeal will not be in vain. Let us feel that we have a position of dignity; and the result will be fruitful in more measures than one.

Feb. 23, 1916. ANOTHER SHOWROOM ATTENDANT.

SIR,—I have read with interest the article by Mr. Cyril Davis, also the various letters of criticism which have appeared.

I agree with "Fair Play" that it is not just to expect a man to dress and live up to a higher standard than his income will allow, as this, in my humble opinion, is the first step on the road to ruin, owing to the man eventually finding himself in debt, with the result that he resorts to the moneylender. His wages or salary should be sufficient to enable him to dress, &c., according to his position. Also, the word "attendant" should be abolished and "salesman" substituted; although during my experience in the gas industry, which is one of twenty-six years, I have never heard any of the public take exception when being referred to the showroom attendant.

I do not agree with the statement made by "Another Showroom Attendant" regarding the inspector—viz., the reason why at times it is found that a different type of fire has been fixed to that recommended by the showroom. It must not be forgotten that, in addition to the cubical space and window area being known, there is the question of the aspect of the room and the draught of the chimney to be taken into consideration; and this is, undoubtedly, the reason of the alteration being made at the time.

As regards the question of educational equipment and knowledge of the gas industry in general, "Showroom Attendant" is perpetrating a very grave error in making such a statement as he has respecting inspectors and assistant inspectors; for he must be fully aware that, before a promotion is made, the man has had to study many hours, attend lectures, and finally sit for an examination, where questions both on practice and theory have to be answered. Then, when the promotion has been given, the man has to serve twelve months on probation, during which period he has to give satisfaction not only to his superior officers, but to the public; and should the latter not be satisfied, a letter is very soon received at the office.

Finally, as to the question of writing letters. It is not a matter of the attendant being incapable of writing a letter, but the inspector is appointed in charge of a district, and is responsible for all that takes place therein. I feel the majority will agree that all letters should pass through the district inspector's hands, and be signed by him.

Feb. 24, 1916. INSPECTOR.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:

Bill read a second time and committed: Burnley Water.

The following Bills are to be read a second time this day week:

Aberdare and Aberaman Gas, Colchester Gas, Ferndale Gas, Hornsey Gas, Imperial Continental Gas Association, Newcastle-upon-Tyne and Gateshead Gas, Yeadon Water.

Petitions have been presented against the following Bills:

Aberdare and Aberaman, by the Aberdare Urban District Council.

Colchester Gas, by the Colchester Corporation, and the Wyvenhoe Gas Company.

Hornsey Gas, by the Gas Light and Coke Company, Great Northern Railway Company, Hornsey Corporation, Wood Green Urban District Council and others.

Newcastle-upon-Tyne Gateshead Gas, by the Durham County Council, Felling and Hebburn Urban District Councils, Gateshead and the Newcastle-upon-Tyne Corporations, and the Trustees of the late Charles Perkins and W. E. Manners.

Yeadon Water, by the Guiseley Water-Works Company, Guiseley, Rawdon, and Yeadon Urban District Councils, West Riding of Yorkshire Asylums Board, Wharfedale Rural District Council, and S. C. Denby.

The Gas Light and Coke Company and other gas companies have deposited a petition against the South-Eastern and London, Chatham, and Dover Railways Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:

Bills read a second time and committed: Beighton and District Gas, Folkestone Gas, Northwich Gas, Plymouth and Stonehouse Gas, South Metropolitan Gas, Tynemouth Corporation Water, Uxbridge Gas, Wakefield Corporation Water.

Water Supply at Naval Establishments.

Mr. PERKINS, on Monday of last week, asked the Secretary to the Admiralty whether his attention had been called to the fact that the Admiralty was employing an official of the Metropolitan Water Board as their expert adviser in connection with the water supply of Admiralty works in Yorkshire; whether he was aware that the Metropolitan Water Board had no authority to deal with water supplies outside their own area; and whether, in view of the fact that many consulting engineers with local experience were at present only partially employed, the Admiralty would in future make use of their experience rather than consult a water authority without local knowledge and already fully employed in its normal duties within its own area?

Dr. MACNAMARA, in his reply, stated that the Metropolitan Water Board had placed the services of certain of their expert staff at the disposal of the Admiralty in connection with water supplies at various naval establishments, including that in Yorkshire, and this valuable assistance was much appreciated. The need of further expert assistance had not been experienced. The Admiralty were acting under their own powers in various districts.

Directorial Changes at Hexham.—No less than three vacancies on the Board of the Hexham Gas Company have been caused by death during the past year. Mr. Dixon Pratt had been a Director for 46 years (and Chairman for 15 years), Mr. W. R. Riddle, for 44 years; and Mr. Joseph Hepworth, for 16 years (previous to which he had been Consulting Engineer to the Company for 20 years). It was announced by the Directors in their report for the twelve months ended Dec. 31 that the vacancies had been filled by the appointment of Mr. W. Pattinson, Mr. F. N. Hepworth, and Mr. J. E. Gibson. The accounts showed a gross profit of £2159; and a dividend making with the interim dividend 5 per cent. for the year, less income-tax, was declared, leaving a balance of £1256 to be carried forward.

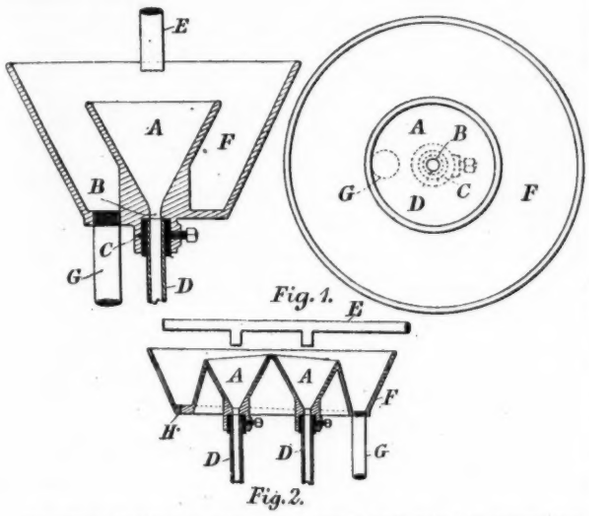
REGISTER OF PATENTS.

Feeding Apparatus for Liquids with Solids in Suspension.

SHEWRING, F., of Droitwich.

No. 21,301; Oct. 21, 1914.

This invention relates to a gravity-feed system of liquids having solids in suspension of such a character as will quickly settle out—such, for example, as a milk-of-lime supply to a sulphate of ammonia still. The object is to prevent the matter in suspension in the liquids settling out in the receiver and in the down pipe leading from it, and "the effectual return of the overflow liquid to the vessel in which the solution is mixed."



Shewring's Feeding Apparatus for Liquids with Solids in Suspension.

Fig. 1 shows a vertical section and a plan of an elevated receiver, combining a primary receiver and an overflow receiver. Fig. 2 is a smaller scale vertical section of an arrangement of the invention with two primary receivers adapted to overflow into a single overflow receiver.

In fig. 1, the primary receiver A is an upright vessel of cone shape through the bottom of which is the outlet B. The inner sides of the vessel are straight, and the outlet joins-up with the sides and leads into a larger diameter concentric socket C, formed on the underside of the receiver, without shoulder, rim, or any other part offering resistance to the free flow of the liquid through the outlet, and which would tend to wipe-out of the solution the solid matter in suspension. To the socket C, by an india-rubber ferrule and a clamping pin, is detachably fitted a glass tube D, forming part of the down pipe. It is similar to tubes used for steam-gauges, and of a diameter calculated to determine the actual size of the outlet from the receiver A. It is a feature in the fitting of this tube to the socket C and to the outlet B that no resistance is offered to the free flow of the solid matter in suspension in the liquid. E is a pipe by which the forced supply of solution is carried into the receiver, which forced supply is always in excess of the capacity of the outlet B D. The supply, being in excess, always maintains an overflow condition of the solution at the top rim of the receiver, and at the same time a constant agitation of the liquid in it. The overflow liquid passes into a second receiver F, which surrounds the primary receiver and is provided with an outlet pipe G for the return of the excess liquid to the solution mixing vessel. This second receiver is also a conical vessel with straight sides, and operates so that the solid matter in suspension is maintained in suspension and returned without settling-out to the solution mixing vessel.

In fig. 2, two primary receivers A are provided within an overflow receiver F, common to both. Each receiver is independent in operation, and has a separate down-pipe D. The rims of the receivers are arranged to overflow outwardly and not towards each other. Both receivers may be fed from a common supply pipe E. G is the pipe by which the overflow solution is returned to the mixing vessel; and with reference to the free flow from this overflow receiver to the pipe G, the bottom H is slightly declined towards the pipe G.

Grids for Gas-Purifiers.

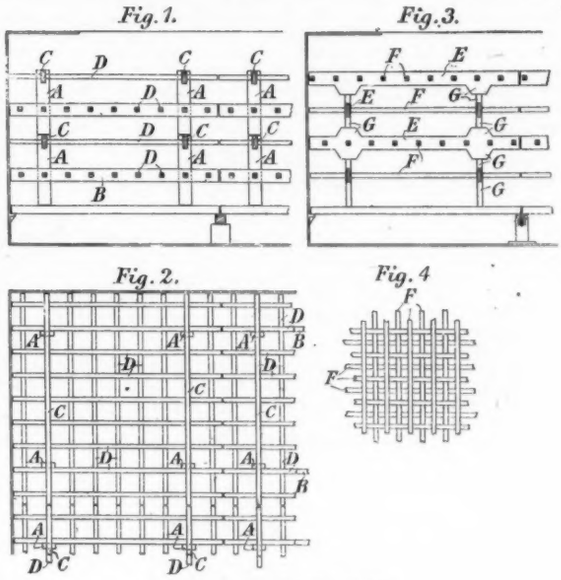
TATE, L. J. V., of Edinburgh.

No. 2644; Feb. 19, 1915.

The object of this invention is "to construct a grid for gas-purifiers, deep filled with purifying material, so that the material may be deposited and supported in a light porous condition, and to obtain a uniform flow of gas throughout the entire mass by splitting up any streams of gas that may form at any point in the purifier."

Fig. 1 shows in elevation an "intersection" grid with vertical and horizontal frame bars and the manner of fitting them in the purifier. Fig. 2 is a plan of fig. 1. Fig. 3 shows the "intersection" grids with horizontal frame bars only. Fig. 4 is a plan of horizontal rails for grids shown in fig. 3.

In figs. 1 and 2, the frame is formed of a number of vertical bars A, supporting four horizontal bars B and C. The two lower bars B are each fixed to two of the vertical bars A, thus forming two sides of the frame; while the two upper bars C are fixed to the vertical bars A of the two frame sides, and form a complete rectangular frame resting on



Tate's Gas-Purifier Grids.

the vertical supporting bars A with the two lower horizontal bars B running at right angles to the two upper horizontal bars C. The grid-bars D are morticed into, or fixed to, the respective tiers of horizontal frame bars B and C at any suitable distance apart, and the tiers of grid-bars run across the frame at right angles to each other in the respective tiers.

In figs. 3 and 4 the frame is formed of a number of horizontal frame bars E with enlarged parts G, which form supports for the successive tiers of grids running parallel to each other. The horizontal grid-bars F are supported on the frame bars E at any suitable distance apart.

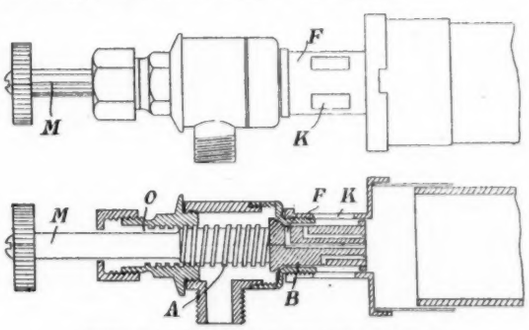
The grid-bars running at right angles to the grid-bars in the tiers above or below intersect the spaces between the grid-bars in the adjacent tiers, and thus intercept the falling purifying material as it is filled into the purifier from the top of the grids, breaking the fall and spreading the purifying material in all directions over a large area and ensuring that it is deposited in a light open condition, also the gas passing through the purifier, upward or downward, is intercepted in its passage by the lines of grid-bars, and is spread over the whole mass within the purifier.

Cocks for Bunsen Burners.

BILLINGTON, W. J., of Tooting, S.W.

No. 6021; April 22, 1915.

This atmospheric burner is of the type in which the shut-off valve for the supply of gas and the apertures for the supply of air are simultaneously opened and closed by operating a handle, so that the gas and air always bear a certain relation to one another.



Billington's Atmospheric Gas-Burner Cock.

An elevation of one form of the invention is given; also a longitudinal section, showing the parts in the position they would occupy when the valve is closed.

A screwed spindle A, co-axial with the part of the bend leading to (say) a stove, has upon it a plunger or piston B, with a conical edge adapted to fit upon a seating formed in a partition extending transversely across the pipe, and which forms the actual valve by which the supply of gas may be entirely shut off. Beyond the valve the aperture in the pipe is reduced—forming a cylinder F, which receives the piston B, "of such size as to fit snugly therein." In the plunger a series of fine holes are bored with right-angled bends opening at different points on the surface of the plunger. In the cylinder are drilled two or more holes K, so that a short bunsen tube is formed;

and within the cylinder the piston works up and down—forming with it the air-control valve.

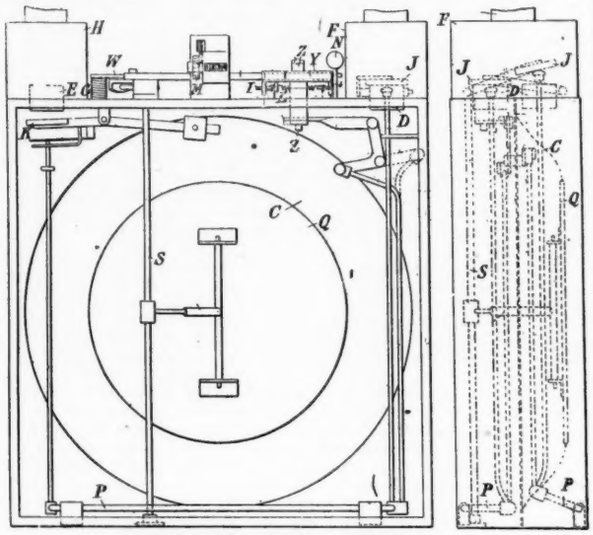
By turning the valve stem M, which passes through a threaded part O of the right-angled bend, the valve disc can be moved from its seating; and gas then passes through the first hole in the plunger. The gas cannot, however, make its way through the remaining holes, because it cannot reach their outer ends, which are within the cylinder. But as the stem is screwed further out, the plunger is moved into the enlargement of the pipe, and the outer ends of the remaining holes are uncovered one by one. Meanwhile, the holes in the cylinder forming the bunsen tube are gradually uncovered by the movement of the plunger—thus increasing the amount of air drawn in by the passing gas.

Dry Gas-Meters.

WHITE, JUN., J., of Handsworth, and CANOVA, V., of Birmingham.

No. 5854; April 19, 1915.

This invention relates to dry meters in which poppet valves are operated intermittently with a quick motion at the end of each movement of an oscillatory diaphragm situated between a pair of measuring chambers. The invention comprises the combination with a lever on a shaft which receives its motion from an oscillatory diaphragm, of a rocking bar connected to the valves, a lever carrying a roller which can move along the bar, a lever to which the roller-carrying lever is attached at one end, a link connecting the roller-carrying lever to the first-mentioned lever, a pair of locking levers at the ends of the rocking bar—the locking levers being adapted to engage the rocking lever and to be disconnected from it by the roller-carrying lever, and operating springs or weights in conjunction with the levers acting on the rocking bar.



White and Canova's Dry Gas-Meter.

In the construction of meter shown, a rectangular case A is formed with a central partition in which is a reciprocatory flexible diaphragm C. At the upper side of the case two cylindrical apertures D E are arranged in conjunction with each chamber—a gas inlet and gas outlet respectively. The inlet apertures for the chambers have their outer ends enclosed in a compartment F, with which communicates the main inlet pipe, and similarly the two outlet apertures have their outer ends enclosed in a chamber H, with which communicates the main outlet pipe. Over the upper end of each inlet aperture is fitted a flat disc valve J, and beneath the lower end of each outlet aperture is fitted a disc valve K. The valves are mounted on levers; and motion is imparted to the valves by rods adapted to lift them off their seatings. The rods of each chamber are operated by their own rocking bar P; the arrangement being such that a closing movement of one of the valves is accompanied by an opening movement of the other.

As in ordinary dry gas-meters, the reciprocatory motion of the diaphragm is utilized for actuating the valves. The usual central plate Q on the diaphragm is connected to a vertical rocking shaft S, which projects through a stuffing-box in the top of one of the measuring chambers. To the end of the shaft is secured a lever, which (by means of a link) is connected to another lever which at one end is pivoted to a spring-controlled lever W and at the other end is provided with a roller which moves across a bar Y secured to a valve-operating shaft Z. During each oscillation, movement is transmitted through the mechanism described to the spring lever W, and the latter is moved during rather more than one-half of the motion against the spring G, which acts directly on the lever and may be supplemented by another spring connecting the lever W and the bar Y. During the movement the roller is moving idly along the bar on the valve-operating shaft.

The arrangement of the mechanism is such that, with the operation of the bars P, the positions of all the valves are rapidly reversed—that is to say, the open valves are closed and the closed valves are opened. The chamber which was previously receiving gas from the inlet is now caused to discharge to the outlet; and the other chamber is put into communication with the inlet. During the reverse movement of the diaphragm the roller again slides across the bar Y on the valve shaft; but no motion is imparted to the latter until a peg securing the bar to the locking lever I is disconnected from the lever by the action of the peg on a projection, then another change-over of the valves occurs. The locking levers are controlled by a spring L, so that they automatically engage the pegs on the bar Y. Simultaneously with the liberation of one peg on the bar the other peg is engaged. By arranging the valves as shown, the normal pressure of the gas tends to keep them on their seatings.

In conjunction with the lever W, a counter is provided to indicate the quantity of gas passed through the meter; and actuation of it is effected by an arrangement of links or levers acting on the ratchet M.

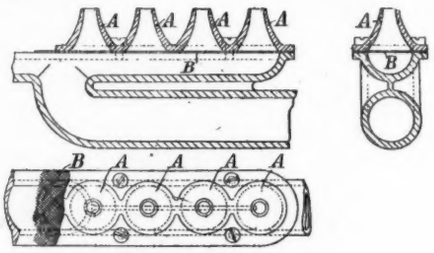
In the operation of the meter as described, the valves remain fully open throughout the greater part of each movement of the diaphragm and close suddenly at or near the end of it. Preferably the valves are arranged so that both inlet valves and both outlet valves remain open simultaneously for a short interval; and the gas commences its flow into, or out of, one of the chambers before the flow into, or out of, the other chamber is completely interrupted. An air-buffer N may be arranged in conjunction with the lever W to control the rate of operation of the valves and permit the reversal to be effected without shock or noise.

Burners for Gas-Fires.

AIRD, KENNETH, of Falkirk.

No. 9369; June 26, 1915.

This invention consists in a two-part burner comprising a cover and a body, "the cover being formed with its lower face plane and with integral upwardly projecting nozzles, each formed with a conoidal cavity, the base of which coincides with the lower face of the cover, and each such cavity being contracted without an interruption from the base to the open end, and a plane foraminous sheet interposed between the cover and the body."



Aird's Burners for Gas-Fires.

As shown, the burner is in two parts, the upper part with integral upwardly projecting nozzles, each of which is formed with a conoidal cavity A, the base of which is contained in the plane of the lower face of the cover. Each cavity is contracted, without an interruption from the base to the open upper end of the nozzle. Interposed between the cover and the body part of the burner is a flat or plane sheet of gauze or perforated sheet metal B constituting a foraminous closure for each cavity, which otherwise is entirely open at the base.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Feb. 23.]

NOS. 2133—2532.

BEHRENS, J.—"Removal and obtainment of sulphur-dioxide from gases." No. 2280.

DAYTON, W. C.—"Making gas from liquid hydrocarbons." No. 2441.

HANAPPE, E.—"Washer-scrubbers." No. 2392.

HELPS, G.—"Gas-cooking ovens." No. 2362.

LEWIS, J. P.—"Cracking hydrocarbons." No. 2509.

MEADS, H. J.—"Gas-lamps." No. 2230.

MORGAN, F. J.—"Gas and air mixers." No. 2409.

MUNRO, H.—"Methods of illumination." No. 2314.

NAAMLOOZE VENNOOTSCHAP A. JURGENS' VEREENIGDE FABRIEKEN.—"Absorbing carbon-dioxide from gaseous mixtures." No. 2331.

NORDDEUTSCHE HÜTTE AKT.-GES.—See Behrens. No. 2280.

PARKINSON AND W. & B. COWAN.—See Meads. No. 2230.

PRICE, A.—See Morgan. No. 2409.

PRYSE, W.—See Morgan. No. 2409.

PULSOMETER ENGINEERING COMPANY.—"Production of compressed gases." No. 2458.

ROLLASON, A.—"Treatment of coal." No. 2356.

Waltham Abbey and Cheshunt Gas Company's High Make.—At the annual meeting of the Company last Wednesday, the report submitted showed a profit on the year's working of £4680. After payment of an interim dividend of 7½ per cent. per annum on the "A" shares, and 5½ per cent. per annum on the "B," "C," and "D" shares, for the half year ended June last, and providing for the interest on debenture stock and loans for the year, as well as an amount of £190 transferred from the profit and loss account for writing-down investments, there remained a balance of £2766, out of which the Directors recommended the payment of a dividend of 8 per cent. per annum on the "A" shares, and 6 per cent. per annum on the "B," "C," and "D" shares for the six months ended Dec. 31, and that the balance of £824 be carried forward. Mr. Henry Woodall congratulated the Company on being in the position of paying ½ per cent. more dividend than last year. With regard to the output of gas, they had made 128 million cubic feet, against 103 millions the previous year; the increase being due to the fact that the Government were using a lot more gas at the factories. They had made 14,850 cubic feet of gas per ton of coal carbonized, and sold 14,036 feet, which he believed was a record for any gas company in the kingdom. The report was adopted.

MISCELLANEOUS NEWS.

CROYDON GAS COMPANY.

The Half-Yearly General Meeting was held last Friday, at the Offices—Mr. CHARLES HUSSEY, J.P., in the chair.

The SECRETARY (Mr. W. W. Topley) read the notice convening the meeting; and the Directors' report and accounts were taken as read.

USE OF GAS AND COAL ECONOMY.

The CHAIRMAN, in moving the adoption of the report and accounts, said the history of the undertaking during the half year had in its main features closely resembled those of the preceding half year. In both, notwithstanding the reduction in public lighting, and the practical extinction of outside shop lighting, the Directors were able to record a slight increase in the sales of gas over the corresponding period of the previous year. As building was almost stationary in the district, this result had had to be achieved by an increased use of gas on the part of existing consumers. As the proprietors doubtless knew, the Government had in various ways indicated the desirability, in the national interests, of securing, through the medium of gas-works, the fullest results from the coal used in the country. It was worth while in this connection to consider for a moment the national advantages obtained by the utilization in this manner of the country's internal fuel resources. If a ton of coal was burned in a fire or furnace, a large portion of its volatile constituents were driven off into the air unconsumed, or partially unconsumed, in the form of smoke, which consisted in reality of wasted fuel. The same result followed if the coal were used under boilers which generated electricity. Not only so, but the valuable liquid and gaseous contents of the coal other than the gas itself—viz., tar and ammonia—were not recovered. Contrast this with the processes carried out in a gas-works, which furnished perhaps as complete an illustration of the fullest and most economical use of raw material as was to be found in the country. Here the coal was subjected to a process of distillation in closed retorts, which extracted from it, firstly, the gas, and next the tar and ammonia. The gas was subjected to various processes of purification, ending in the clean and adaptable fuel which consumers had always "on tap," and which could be used for lighting, heating, motive power, smelting, brazing, and many industrial processes by means of the efficient appliances devised by latter-day scientific research, and made available by the Company for the use of their customers. So from the gas when consumed they had a near approximation to the minimum of waste in use. The tar was converted by distillation and chemical treatment into substances almost unlimited in number, some of which were necessary for the production of munitions of war, and, as such, were urgently needed by our own and the Allied Governments for use by their armies. The ammonia was converted into the most valuable of artificial manures, sulphate of ammonia, the use of which the Government were urging upon the farmers to enable them to increase the home agricultural products, and thus lessen the necessity for imports, which at this time not only affected adversely the financial position of the country in the markets of the world, but increased the difficulties due to the inevitable shortage of shipping and the consequent high rates of freight. There remained the coke, which was a cleanly and smokeless fuel, burning with a high temperature, and giving, when fires or furnaces were suitably adjusted for its use, actually better results per ton than the ordinary qualities of coal, while the price at which it could be sold made it the cheapest solid fuel obtainable.

RECORD FIXING OF GAS-STOVES.

The Company were doing what they could to press these considerations home to the minds of the consumers, and that their efforts were not without success was, he thought, shown by the fact that the increase in the number of gas-stoves in use—3631 in the half year—very largely exceeded that of any previous half year in the Company's history. For the first time, the stoves hired from the Company (not counting the large number which had been bought outright) exceeded the total number of gas accounts—being 47,886, against 46,319. This naturally meant a very large amount of work falling to the share mainly of the distribution department. When he told the proprietors that, in the one year of 1915, they fixed or removed 23 050 stoves, to say nothing of 10,690 meters, to satisfy the requirements of their customers, it would be seen that, with a staff already depleted and almost daily being reduced by enlistment, those who remained to the Company (assisted it was true by the willing service of temporary male and female employees) had had no easy time. The proprietors would, he was sure, join with him in recognizing the way their employees had taken, and were taking, their share of the national burden in these trying times.

ITEMS FROM THE ACCOUNTS.

The accounts, enabling (as, in accordance with the custom of many years, they did) a comparison to be made with the corresponding figures of the previous year, called for little detailed comment. It would be seen that the chief feature was the large increase in the cost of the raw materials, which was partly offset by an increase in the receipts from residuals. Materials generally were much advanced in price. The charge for war bonus (to assist their men in meeting the increased cost of living), and for payments to dependants of men on service, would, he was certain, meet with the hearty approval of the proprietors. These payments were on a scale which had been carefully considered, and were designed, on the one hand, to ensure that no employee serving his King and country should feel anxiety as to the monetary welfare of those he left behind, and, on the other, to enable the Directors to maintain, as they hoped to do, and as he was sure the proprietors wished them to do, these benefits undiminished under the more difficult circumstances which would face them in the immediate future.

COAL, OIL, AND RESIDUALS.

The Company had not yet felt the full incidence of the charges due to the war. So far the raw materials had been largely received under contracts made in pre-war times. On seaborne coal, they had had to pay increased prices due to high rates of freight; these amounting at the present time to the equivalent of nearly 9d. per 1000 cubic feet of gas made. They had also purchased Midland coals at advanced prices, though the Act for the limitation of the price of coal had given them a little, if somewhat uncertain, relief. With regard to oil, the pre-war contract was just running out; and their purchases in the coming year would probably cost some £16,000 more under this heading alone. It was due to the firm who had been supplying them that he should acknowledge the way in which their contract had been faithfully carried out through times during part of which the freights ruling were as much as eight times those on which the sale price was based. This must have meant a heavy loss; but the Company's requirements had been fully met. The new contract was based on a rate for carriage six times the normal. But, being on a sliding-scale, if, as the Directors hoped might be the case, there was—if not immediately, then during the coming year—some easing of shipping freights, they might share in this relief. Be that as it may, they would have to pay in the near future much higher prices for their raw materials without the prospect of any proportionate gain from residuals, which, at the moment, showed rather a downward than an upward tendency, and which in any event could not be looked to for any considerable help towards the coming burden of higher costs.

POSSIBLE FURTHER INCREASE IN PRICE OF GAS.

The proprietors would not be surprised, therefore, when he said that, unwilling though the Directors were to raise the price of gas, some increase might in the near future be found unavoidable. So far the price had been increased by 4d. per 1000 cubic feet only, while neighbouring companies had found increases of 6d., 7d., and 8d. necessary. He believed that the consumers, should the Directors unfortunately find it impossible to avoid a further advance, would recognize that they were passing on to them as little as they possibly could of the additional expenses the Company were forced to incur, and that they had tried to defer any increase as long as possible.

WAR LOAN AND AIRCRAFT INSURANCE.

The Directors had converted their investments of Consols into 4½ per cent. War Stock; and the proprietors would see that the reserve and insurance funds were written-down in consequence. This conversion would, however, give a greater yield in interest, the whole of which was applied to the augmentation of these funds. A considerable expenditure had been incurred on insurances which the Directors last summer thought it wise to make against damage by hostile aircraft. They hoped that next year there would be no need for a recurrence of this expenditure.

DERELICT GAS-WORKS AND WAR REQUIREMENTS.

The gas-works at Whyteleafe, which were closed-down in 1906 after the amalgamation with the Caterham Company, had been let to a firm having a contract with the Government for army supplies. Here the Company would benefit from the rental received, and to a small extent from the use of gas. It was interesting also to note that, within the last few days, an inquiry had been received for the purchase, or rental, of the old gas-works at Carshalton, which had been unused for 21 years, or since the amalgamation with the Carshalton Gas Company. This inquiry also arose from war requirements.

CONSTRUCTION OF NEW GASHOLDER STILL IN ABEYANCE.

The large holder in process of erection at Waddon was to have been ready for use last autumn. Owing, however, to pressure of Government work and shortage of labour, the contractors (whose undertaking had been taken over by the Ministry of Munitions) had had for the present to suspend work; and, as a consequence, the Company had this winter been without the additional storage capacity upon which their Engineer had counted. Fortunately, the darkest days were unaccompanied by severity of weather. The Directors hoped that this summer might see the completion of the work, as without the holder they would, if next winter was a cold one, have to work under conditions of very great difficulty and anxiety to their Manager and staff.

THE CARRY-FORWARD.

The dividends recommended would enable them to carry-forward a sum less by only £58 than that which was brought into the accounts.

The DEPUTY-CHAIRMAN (Mr. Thomas Rigby), in seconding the motion, said he thought, under the circumstances the Chairman had mentioned, that the proprietors would agree that the half-year's working had been satisfactory.

Mr. A. W. OKE, referring to the excellence of the report, said that some of the proprietors no doubt attended the meeting feeling that the Chairman would probably have to paint the position in somewhat dark colours. He was sure that such proprietors would feel relieved that they could go away with optimistic feelings. There was no question that this was largely due to the prudence of the Directors and the officials in making such long and excellent contracts. But the Board and the officials must have been much hampered during the winter months through not having the new gasholder. In spite of all the difficulties, however, there was only, as the Chairman had told them, something like £53 less in the balance to be carried forward. When they remembered the price of gas was only 2s. 9d. in Croydon, he was sure that the consumers must be very grateful, and the proprietors, being under the sliding-scale, must also be thankful that they were able to enjoy substantial dividends, in spite of the difficult times. He spoke in approval of several points mentioned in the Chairman's speech, and said he should like to feel that the Chairman's opening remarks, regarding economy in the use of coal, could meet with a much wider audience. The most economical use was by burning the gas derived from the coal, so as to save the other constituents. The good results put before the proprietors were due to the application of science in the manufacture and use of gas; and what one would like to see in every gas balance-sheet was money spent in research with the view to further development.

The motion was unanimously carried.

THE DIVIDENDS.

Sir CORBET WOODALL said he was present that day contrary to advice, and upon condition that he did not attempt to make a speech.

But he felt the time was such that one ought, if at all possible, to be present at the meeting of the proprietors—not to neglect any duty. It was his pleasant duty to propose the payment of dividends at the same rates per annum as last half year—that was to say, 14½ per cent. on the "A" stock, 11½ per cent. on the "B" and "C" stocks, 5 per cent. on the "D" stock, and 10 per cent. on the "E" stock, all less income-tax. A great satisfaction to them all was to know that these dividends had been earned. They had in the past half year made a much larger balance of profit than they did in the same period of the previous year. The profit on the working was rather more than £28,000; and they were carrying forward a balance practically the same as last year. Besides this, they had a sufficiency in reserve to pay, if he was not mistaken, some eighteen months' dividend. The Chairman had spoken of the fact that the circumstances in front of them were uncertain and risky. They all knew this quite well, and agreed with him. But the state of their finances was such as to enable them to look with a degree of complacency to the immediate future, which it was not open for everybody to do. The price of gas had been increased but slightly—only by 4d. per 1000 cubic feet. It was open to them (as the Chairman had suggested they might have to do) to further raise the price; but nevertheless he saw no reason in the present position of the Company why they should be downhearted. The nation was engaged in a great struggle, on which all their minds were fully fixed. They knew they were engaged in this for reasons that no question of personal loss would materially affect; and they were going on with it even though considerable personal inconvenience was suffered. At present they could hardly say the inconvenience had been very great; but whatever it might be, they were all of them, he was sure, prepared to meet it, and carry through the struggle to the end. If it meant a temporary reduction of the dividend, the proprietors would be ready to face it. At the present time, they could rejoice that the excellent dividend had been fully earned, and that there was no risk about the dividends in the near future.

Mr. WILLIAM CASH seconded the motion, which was unanimously adopted.

RE-APPOINTMENT OF DIRECTORS AND AUDITOR.

Mr. PERCY H. HALL proposed the re-election of the Chairman as a Director. After the speech they had heard from the Chairman, it needed no words from him to recommend this resolution to the acceptance of the proprietors. They were always pleased to see Mr. Hussey's genial presence at the meetings; and they felt the same at the Board. Under his able guidance, the proprietors might be sure the true interests of the Company would be observed.

The DEPUTY-CHAIRMAN, in seconding, said Mr. Hussey had been a Director nearly 26 years, and he was still "going strong."

The CHAIRMAN, in reply, spoke of the unbroken good feeling that existed between himself and the other members of the Board, and of the kind way in which the proprietors always received what he had to say.

Mr. CASH moved the re-election of Mr. Samuel Spencer, who, he said, had been a valuable Director ever since the amalgamation with the Carshalton Company.

Mr. W. J. RUSSELL, in seconding, said that one of Mr. Spencer's strong and valuable points was that he was always well informed regarding the prices of metals and metal goods. This made his services very useful to the Board.

Mr. SPENCER having acknowledged his re election,

Mr. CHARLES WEBB proposed, and Mr. SAMSON seconded, the re-appointment of Mr. F. S. Sloman as an Auditor.

VOTES OF THANKS.

Dr. G. H. RODMAN proposed a vote of thanks to the Chairman and Directors. He remarked that in times of stress such as those through which they had been passing, it was particularly their duty to give the Directors their grateful thanks. Had it not been for good work on their part, he was sure the proprietors would not have had anything like the favourable report that had been submitted at this meeting. The difficulties they had had to surmount had been considerable; but, under the conditions of stress, they had been extremely successful.

Mr. J. T. MAITLAND seconded the motion, which was heartily carried.

The CHAIRMAN, in his reply on behalf of his colleagues and himself, thanked the proprietors for their expression of approval. It was true they had had a great deal of anxiety during the half year. There was above all the anxiety as to obtaining the quantity of coal they required. Fortunately, they were able to get in a good stock in the autumn; and this had been most useful. On many occasions they had had to take out of store, which was not a thing they liked to do; but now they were able to put a little into stock, and so supplement it. They had also (so to speak) been "commandeered" by the Government, and had had to put down certain plant for the extraction of toluol from the gas. This had not been an expensive matter; but it had given their Engineer and Works Manager (Mr. Caddick) rather more to do. Proposing a vote of thanks to the officers, their staffs, and workmen, he said that Mr. Caddick had had a great deal of anxiety in common with the Directors, and especially in connection with the supply of coal. Mr. Topley was, as ever, an indefatigable worker for the Company; and their Distributing Engineer and Sales Manager (Mr. W. J. Sandeman) had had a very pressing time during the half year, as was shown by the statistics he (the Chairman) had given in his speech. The time had been made more strenuous by the number of men who had gone to the front. When he mentioned that 230 of their staff and employees had joined the Colours, and it was expected that shortly another 100 would go, the proprietors would appreciate the difficulties there had been in carrying on their business. But the men remaining had made up their minds to as far as possible fill the vacancies by working later and by putting as much zeal as they could into their work. Mr. Haines, the chief of the rental department, was unfortunately ill; but, with the rest he was having, the doctor hoped he would soon be able to return. In Mr. Anderson they had, as Mr. Topley would acknowledge, an able assistant in their secretarial work.

Mr. SPENCER seconded the motion, which was heartily carried.

Mr. CADDICK, on behalf of all engaged at the works, sincerely thanked the Chairman for his kind words and the proprietors for their confirmation. They were, he said, indeed living in strenuous times; and, for any chief of a gas-works at the present time, the office was no sinecure. He could not speak too highly of the efforts his staff and men had put forward in these troublous times, to assist him in every direction. In connection with the subject of coal stocks, he mentioned, as a point of interest, that, at the beginning of September, they had about 30,000 tons of coal in stock, while their normal stock at that time of the year was about 15,000 tons. Their stock that day was about 15,000 tons; so that the proprietors would see the wisdom of the Directors in having given him the necessary permission to put down larger stocks of coal. Had they been satisfied with their normal quantity, it was easy to see the position now would have been very precarious; they would have been practically out of coal, instead of having six weeks' supply in hand.

Mr. TOPLEY, on behalf of the clerical staff, also thanked the Chairman for his kindly references to their work in these trying times, and the proprietors for their endorsement. He also took the opportunity of tendering his personal acknowledgments to those who had worked with him during the half year, and not least to those of whose temporary service the Company had availed themselves.

Mr. SANDEMAN, in the course of his reply, said the Chairman had mentioned that the Distribution and Sales Department had had a strenuous time during the half year. He (Mr. Sandeman) very cordially agreed with him. They had had an enormous amount of work with which to deal; and they had had to do this with a depleted staff. He was proud to say the staff and workmen had done their best to keep things going; and the balance-sheet showed they had been successful.

SOUTH SHIELDS GAS COMPANY.

Mr. J. H. Penney's Long Service.

The Annual General Meeting of the Company was held last Thursday—Mr. JAMES READHEAD, J.P., presiding.

The report submitted stated that the abnormal situation created by the war has caused a decrease in gas consumption of 5·7 per cent., due to the abolishing of public lighting and restricted lighting generally. The revenue account showed a decrease of £2430 in receipts, and of £1548 in expenditure. The prices of all materials had advanced, and wages had been increased by the war bonus. Residuals had yielded £427 less than the previous year. The price of gas was increased 2d. per 1000 cubic feet from July 1, which necessitated a corresponding decrease in the dividend payable under the sliding-scale. The Jarrow works reconstruction was not yet completed; but gas was being made there, and also at South Shields. The works were insured for damage by aircraft or bombardment. In August last, the Secretary (Mr. J. H. Penney) completed 50 years' service with the Company; and the Directors, on behalf of the shareholders, presented him with a silver salver and a cheque in commemoration thereof.

The CHAIRMAN, in moving the adoption of the report, remarked that the income for the past year was £107,803, and the expenditure £86,397; leaving a profit on the year's working of £21,406, which was just sufficient to pay interest and the statutory dividends and to carry forward £304 to the current year, after writing-down investments in Consols to the extent of £514. Owing to the increased cost of labour and material, the price of gas had to be increased 2d. per 1000 cubic feet as from July; and this necessitated, under the operation of the sliding-scale, a reduction of the dividends payable for the second half year. Though coals had cost more per ton than in the previous year, the total amount paid for coal and oil was less by £723, due to the smaller quantity used by reason of the decreased gas consumption caused by the war. The war had prevented the completion of the Jarrow works reconstruction scheme; and it was unlikely that it would be completed this year. During the past year, the Company had paid in wages £25,864, including war bonuses to workmen; and a further war bonus had recently been granted. Over 50 per cent. of the employees had joined the Colours or attested—practically every one of military age having attested. This was a most creditable record. Major Chapman, one of the Company's Auditors, had been awarded the D.S.O. Their reserve funds amounted to £31,366. He alluded to the absence, through indisposition, of the Secretary (Mr. J. H. Penney). This was the first annual meeting at which Mr. Penney had not been present during his long service as Secretary to the Company. In conclusion, the Chairman warmly congratulated Mr. T. H. Duxbury (the Engineer) and his staff on the satisfactory way in which they had got through a strenuous year.

The resolution was agreed to, and a dividend was declared on the consolidated and new stock at the rate of 4 per cent. (less income-tax) for the half year ended Dec. 31 last, making a dividend for the year of 8¼ per cent., and a dividend on the ordinary stock of 2¾ per cent. (less income-tax) for the half year, making a dividend for the year of 5⅝ per cent.

Cowes Gas Undertaking Finances.—With regard to the sale of coke at the gas-works, it was suggested at Tuesday's meeting of the Cowes District Council that, in view of the high price of coal, ratepayers should be able to purchase it at a lower price than persons outside. Alderman Fellows said they experimented in trying to sell things cheaply last year, with the result that they came out with an adverse balance of £1000 on the operations of the gas-works; and the price of gas had to be increased 9d. per 1000 cubic feet.

Mirfield Gas Company.—The profit made by the Company on revenue account for the year ended Dec. 31 amounted to £6001, out of which the Directors recommended that a dividend should be paid at the rate of 5 per cent. per annum on the ordinary stock, less income-tax. In recording with regret the loss through death of Mr. Marmaduke Fox, who was for twenty years a member of the Board and for sixteen years Chairman, the Directors intimate that they have decided for economic reasons not to fill the vacancy on the Board thus created, "during the existing abnormal conditions, or until the termination of the war."

PORTSEA ISLAND GASLIGHT COMPANY.

The Half-Yearly Meeting of the Company was held last Thursday, when Mr. R. EDGCOMBE HELLYER (the Chairman) presided.

The CHAIRMAN, in proposing the adoption of the report and accounts, pointed out that, compared with the corresponding period of the previous year, the result of the half-year's working showed a reduced gross profit of £1764; and in order to pay the statutory rate of dividend, as recommended, it would be necessary to again draw upon the balance at the credit of the profit and loss account brought from the previous half year. Having regard, however, to the general increase in the cost of all materials and labour, and the continuance of the normal charge for gas, he thought the result was one with which the shareholders had every reason to be satisfied. Referring to the great difficulties experienced in consequence of conditions created by the war, he stated that every possible effort had been made to build-up reserve stocks of coal and oil during the summer; but, unfortunately, their efforts had not proved successful. Owing to the irregular deliveries of coal and oil, especially by sea, during the winter, it had been necessary for a time to reduce the pressure of gas throughout the district. This course had been taken with great reluctance by the Directors, as it was quite realized that it would involve considerable inconvenience to the public; and he wished to avail himself of this opportunity of thanking the Corporation and consumers generally for the consideration that, at such times, they had shown. Not only had there been difficulties with regard to obtaining materials, but, as was general in all industries, from the serious shortage of labour. Of the Company's men, 224 had already joined His Majesty's Forces, or were employed on munitions work, and an additional 153 had attested, making 377, or 53 per cent. of the total employees who had offered their services in the country's defence. As a large number of the other men were beyond military age, he considered the record was one of which the Company had every reason to be proud. The demand for gas had been prejudicially affected by the more stringent regulations of the Military Authorities, the cessation of building operations, and the temporary inability of the Company to execute orders for cookers, gas-fires, &c.; the last being due to the difficulties in obtaining the appliances, and the great reduction in the number of fitters. Notwithstanding these conditions, however, the gas sold was 3,000,000 cubic feet in excess of the latter six months of last year; while the number of consumers was increased by 759 to 50,673, and 992 more additional hired cookers and heating appliances had been fitted. He thought that, having regard to the very great increase in the price of coal and oil, and requisites generally, the necessity for increasing the price of gas would be fully appreciated. The new contracts for coal had not been completed; but for oil the Company were now paying over 100 per cent. in excess of last year's prices. This item alone would involve an additional expenditure of, approximately, £20,000.

The report and accounts were then adopted; the retiring Directors and Auditor were re-elected; and the usual donation of £50 to the Portsmouth Portsea, and Gosport Hospital was granted.

A vote of thanks to the Chairman and Directors, the Engineer and General Manager (Mr. J. D. Ashworth), the Secretary (Mr. H. A. Stibbs), and the staff, for their efficient management of the Company's business, was proposed by Mr. F. Blake. In reply, the Chairman said that it had been an extremely anxious time for all concerned, and for Mr. Ashworth in particular.

NEW SHOW-ROOMS AT DERBY.

Reference was made by the Chairman of the Derby Gas Company (Colonel G. Gascoyne) at the recent annual meeting [*ante*, p. 429] to the Company's new show-rooms; and an invitation was extended to the consumers to visit the premises, and see the latest gas appliances. He spoke of the credit that was due to their Architect (Mr. Thorpe), and the various contractors, "for the skilful manner in which they had carried out what he was informed was a new departure in show-rooms." The following particulars regarding what has been done have since appeared in the "Derbyshire Advertiser."

The rooms are beautifully fitted up with oak panelling, and present a most attractive appearance; while on the various mantelpieces over the latest styles of gas-grates are to be found some very attractive specimens of Royal Crown Derby china. The use of gas fires has increased very rapidly during the past two or three years; for the question of whether gas-fires are healthy to use has been conclusively answered in the affirmative by the medical profession on many occasions. The Company have on exhibition several splendidly designed grates with an artistic finish which are sure to meet the most fastidious tastes—some being in steel, some copper, and others black; while there is also a very neat device for fitting into existing fire grates, which, when heated, presents the appearance of a good coal-fire. A speciality is made of self-contained steam-radiators for heating schools, halls, &c.; while there is on view a safety gas-radiator for use in the garage. There is, in addition, a hot-water radiator for the garage or greenhouse. With regard to house lighting, everything is on the most artistic lines; and there is a surprising variety of fittings, shades, &c. Moving pendants for guiding the light in any direction are sure to prove a boon; while pneumatic distance lighters are exceptionally handy. Perhaps the greatest novelty of all is the "Telephos" electrical lighter, by which the lamps in the room may be turned on by merely pressing a button. For this purpose, no bye-pass is required, the whole thing being worked by a small dry battery about the size of the pocket flash light variety. Another lighting contrivance takes the form of the ordinary electric light switch in appearance; but in this instance a bye-pass is used. The domestic gas appliances are equally ingenious and handy. Several great improvements have been made in cooking stoves, such as plate-racks, enamelled and plated fittings and backs to keep the walls clean; while a handy contrivance hangs on the side—namely, Stone's little bye-pass—which is always ready to light the burners, and so save matches. Aluminium utensils are also on exhibition. A most useful combination of very small dimensions, which, on the old lines, could only be used as a grid or for toasting, has now been adapted for baking—the heat being evenly distributed. For use in summer, the Company have a very handy and efficient auxiliary water-heater for attaching to the kitchen range; so that there is still a good supply of hot water after the fire is out. This is controlled by an automatic valve which turns down the gas as soon as the water is hot, or *vice versâ*, when the water-taps are turned on; thus economizing considerably in gas. Similar appliances on smaller lines—namely, self-contained boilers—are sure to be found most useful for the lavatory basin, or in the hairdresser's shop. A hot-water geyser for the bathroom has been so designed that after a few seconds, when the tap is turned on, the gas is automatically lighted and the water heated as it passes through the geyser; but there is no danger of the heating pipes getting burnt, for the gas is only alight while water is passing through.

WAKEFIELD GASLIGHT COMPANY.

Alderman G. A. Moorhouse, J.P. (Chairman), in presenting the report and accounts for the past year at the annual meeting of the Company on Monday of last week, said that, owing to the greatly increased prices of coal and all other materials, they had been compelled to raise the price of gas last Midsummer 4d. per 1000 cubic feet, which necessitated a reduction of the dividend of 1 per cent. The balance-sheet was very satisfactory, as it showed that the balance of revenue account was practically the same as last year—£12,733, as compared with £12,730; and as they were compelled to pay a smaller dividend, the carry-forward was increased by the sum of £1593. There had been a falling-off in the consumption of gas amounting to 7,241,000 cubic feet, or 2·39 per cent., which was entirely due to the restricted public lighting. The make of gas per ton of coal (12,153 cubic feet) was their highest on record. For the first time in the history of the Company, purification had been a source of revenue. It had cost nothing, and had yielded a profit of £207; whereas a few years ago purification cost them regularly from £1000 to £1200 per annum for a smaller production of gas. The year had been most harassing. The difficulty of getting coal, the scarcity of carters, the depletion of the staff and workmen, the requirements of the Ministry of Munitions, and the consequent increase of naphthalene troubles, had made the year one of great strain on the Directors and officers.

In moving a vote of thanks to the managing and secretarial staffs, Alderman W. H. Kingswell, J.P. (one of the Directors), spoke in the highest terms of the devotion shown during this trying period.

IPSWICH GAS COMPANY.

In the unavoidable absence of the Chairman (the Right Hon. Sir Daniel Goddard, M.P.), owing to his being a member of the Franco-British Parliamentary Committee, the annual meeting of the Company, on Monday of last week, was presided over by Mr. F. Fosdick, J.P. (the Vice-Chairman); but a written statement by the Chairman, referring to the year's working, was read to the proprietors.

In this, it was pointed out that the average rate paid for bringing coals to Ipswich from the North in pre-war times was about 3s. 6d. per ton; but last year no vessels could be chartered for twice this sum, and they had had to pay as high as 15s. a ton for a German interned boat—an awkward and unsuitable craft for discharging with grabs, but the only vessel available. Nor had the "boom" in freights reached its highest point in 1915; for early in the present year the Admiralty took the s.s. "Holmside," of 1200 tons burthen, which the Company had chartered to bring coals at a reasonable rate up to next June, forcing them into the market, where they had to pay 17s. for the only vessel offered. It seemed a pity that the Government, when limiting the price of coal, did not go a step farther, and restrict the rates of freight for carrying the coal to public utility concerns. He was glad the Government now seemed to realize that something must be done in this direction. In addition to providing material for explosives, the use of gas in Ipswich had played an important part in the manufacture of munitions—being extensively utilized in the large works of the town in a variety of processes in shell manufacture. They had also provided their quota of men to the forces; no fewer than 60 having joined the Colours (representing 35 per cent. of the employees), and 20 others having attested. There had been an increase during the year of 2½ per cent. in the amount of gas sold; and the make per ton of coal had improved from 12,435 to 12,672 cubic feet. Owing to the Lighting Restrictions Order, the Company offered to cancel the existing public lighting contract; and this had been accepted by the Corporation. For it, the Company had substituted an agreement at a slightly enhanced rate for such lamps as might be lighted during the war, and a nominal charge towards wear and tear in respect of those which were for the time being unlighted. Co-partnership cost £20 more; the rate of bonus being the same on a larger wage-bill. He was pleased to say they now had 35 of their employees who were shareholders in their own right. In consequence of the increase in the price of gas, the bonus would be less in the current year; but he hoped the reduction would be only temporary. Allowance to employees on war service appeared for the first time. In addition, work would be found for those men who had retained their connection with the Company, when they returned, as they trusted they all would do. He was happy to be able to report that up to the present there had been no casualties among the men, though some were on sick leave.

The meeting unanimously adopted the report, which stated that, after paying the interim dividend, the balance of profit and loss account was £19,446. The Directors recommended that a further dividend at the statutory rates allowable on the increased price of gas be paid. A balance would then remain of £14,017. Owing to the great advance in the cost of coal and rates of freight, the price of gas to ordinary meter consumers had been increased since June last by 4d. per 1000 cubic feet. With the exception of tar, better prices had been realized for residuals.

BOURNEMOUTH GAS AND WATER COMPANY.

The Ordinary General Meeting of the Company was held last Friday at the London Offices, No. 90, Cannon Street, E.C.—Mr. G. CRISPE WHITELEY in the chair.

The SECRETARY (Mr. H. A. Plumb, F.C.A.) read the notice calling the meeting, and the Directors' report and the statement of accounts were taken as read.

IN THE CIRCUMSTANCES, HIGHLY SATISFACTORY RESULTS.

The CHAIRMAN said he had the pleasure, and it would have been an equal pleasure with past years were it not for the extraordinary conditions under which they were living and carrying on business, to present a report which, under other circumstances, would have been considered by the proprietors as thoroughly satisfactory, but which must be looked upon in a somewhat different light at the present time. The report before the shareholders showed a very satisfactory increase in the sale of gas; for whereas there was a decrease of no less than 69 per cent. in the public lighting, this was more than made up by an increase of 8 per cent. in the consumption of the ordinary consumers, and 8 per cent. in that of the prepayment consumers, so that a general increase of 2 per cent. could be reported. The residuals had done well, and more than well; and the water-rental had also increased in a most gratifying way. Perhaps the most remarkable thing the accounts showed was the excellent sale of cookers, fires, and water-heaters; for, during the year 1915, they had taken for such appliances no less a sum than £16,000, which was easily a record in the history of the Company. With these facts before them, the proprietors would not be surprised that the Directors were suggesting the payment of the statutory dividends, and yet have an increased carry-forward.

COAL AND THE FUTURE.

So far so good; but—and there was a very large "but" in this case—the Directors had not only to tell the proprietors what had happened during the six months in order to get this report, but, as the proprietors would realize, the Board had also had to prepare for the future, which was certainly not so rosy as they would like it to be. The history of the six months had been one long and continuous struggle as to how, when, and where they could obtain coals, and, when they had bought them, as to how they could get them into their stores. Under the circumstances, they had, of course, had to increase the price of gas, which carried with it a corresponding reduction in the dividends and in the employees' bonus. Therefore, with what he could not but help considering was the excellent system under which they worked by Statute, the consumers, the proprietors, and the workers were all taking their share in the troubles that surrounded them. He could assure all concerned that, once the Directors could see their way clear to acquire coal and place it upon the works at anything like a reasonable sum, down would come the price of gas, and up would go the dividends and the workers' bonus. But, as he had said before, the time was not yet. The future did not look particularly brilliant; and he could at present hold out very slight hope of a mitigation of the troubles they were passing through.

THE RESERVE FUND.

There was one matter with regard to the accounts to which he should like to draw attention. That was the manner in which they had dealt with the reserve fund. The 2½ per cent. Consols had been converted into 4½ per cent. War Loan stock. The proprietors would not be surprised at this, or at the ascertained depreciation they had charged to the reserve fund. Of course, there was further depreciation still uncovered; but no good purpose would be answered by writing-down the securities at the present moment. They were unrealized securities; and the value of part of the depreciation might be recovered before they had any need, if ever, to deal with them.

WORKS, MEN, AND MUNITIONS.

Speaking generally, he had really said all that could be said wisely on the present occasion. The works and distribution system had been maintained in the usual way; but they had postponed much work which would have been done under happier circumstances. The proprietors would be pleased to hear that at least 200 of their men were serving with the Colours; and although many had been wounded, he was glad to be able to report that only two had been killed, which was a very small proportion. The Company were doing all they could to aid the Government, under the existing circumstances, to provide training accommodation for new troops; and the old works at Bourne Valley were now being used as a training-ground for 700 men. With regard to munitions, they had rendered material assistance to the Munitions Department, although perhaps, it would be neither wise nor permissible to give details as to the methods in which this had been done. That was the report—satisfactory in some ways, otherwise in some. They had had, and were having, very anxious times. He could only promise the proprietors that the Directors would use their best endeavours to carry out the work of the Company as well as it could be carried on under the adverse circumstances. On the whole, he might congratulate the proprietors on the fact that the Company had not been so unfortunate as they might have been. He moved that the report and accounts be received, adopted, and entered on the minutes.

Sir CORBET WOODALL said he should have been content simply to have seconded the resolution, but he thought the proprietors ought to realize that, while there were unsatisfactory circumstances in front of them, these were not of a special or unusual character. The Company were, in fact, in a singularly good situation, having regard to the state of the country. They had in the past half year, as the proprietors knew, added to the amount of the carry-forward after paying their full dividends; they were also paying a considerable sum this half year, in common with other half years (their reserve fund was untouched) to depreciation for the writing-off of the value of abandoned works, and yet they had only increased the price of gas by 4d. per 1000 cubic feet, which was certainly less than the average of their friends and neighbours. They were fortunate in a contract for the conveyance of the greater portion of their coal at a comparatively low rate; and therefore the prospect in front of the Company was, he thought, as good as that of any company of which he knew. Of course, the time was full of anxiety; but he saw no reason why they should look gloomily upon it. The Board would, as the Chairman had promised, do all in their power in the circumstances; and he thought they were in a position to do as well as they could possibly expect. This being so, he had great pleasure in seconding the motion.

The motion was unanimously carried.

THE DIVIDENDS.

The CHAIRMAN moved, and Mr. WILLIAM CASH, F.C.A., seconded, the declaration of dividends at the following rates per annum: On the preference shares 6 per cent., on the ordinary shares 7 per cent., and on the original shares 15 per cent, all less income-tax.

This was agreed to.

ELECTION OF DIRECTORS AND AUDITOR.

The CHAIRMAN next moved the re-election of Sir Corbet Woodall to his seat at the Board. He remarked that it was about nineteen years ago that the state of the Board was fairly critical, owing to death and ill-health. They were in straits with regard to members of the Board; but one morning a (he thought he might call it) happy inspiration led him to take a cab and go to Westminster, and invite Mr. Corbet Woodall (as he then was) to come and help in the work of the Company. He (the Chairman) was glad and delighted that the invitation to which he had referred was accepted; and he thought that he had never done a better morning's work than when he took that short journey to Westminster. The Company had since had the services of Sir Corbet; and they had been of the highest possible value. He was sure he was only emphasizing the desire of the proprietors when he asked Sir Corbet to continue to serve the Company.

Sir CHARLES J. JESSEL, Bart., in seconding, remarked that Sir Corbet Woodall was the *doyen* of the gas industry, and his presence on any Board was an honour to his colleagues and a great advantage to the proprietors.

The motion was heartily passed.

Sir CORBET WOODALL having acknowledged his re-election,

Mr. ARTHUR WOODS moved the re-appointment of Mr. F. G. Barrett as an Auditor, and that the fees of each Auditor be increased to 110 guineas per annum. Their last increase in remuneration was in 1909; and since then the Wimborne Water-Works and the Christchurch gas undertaking had been acquired; and the business of the Company had been very largely increased.

Mr. A. W. OKE seconded the motion, and it was adopted.

Mr. BARRETT thanked the proprietors for his re-election, and for the increase in remuneration.

VOTES OF THANKS.

Mr. R. H. GLEN, F.C.A., in proposing that the thanks of the proprietors be given to the Chairman and Directors, the officers, their staffs, and the workmen, observed that they all more than usually deserved this recognition

Mr. BARRETT seconded the motion; and it was cordially passed.

The CHAIRMAN said the Board and himself accepted the vote of thanks with a great amount of pleasure. During the long number of years the proprietors had placed their confidence in him; his conscience had sometimes pricked him as to whether he had really justified the confidence; but when he reflected on the success of that journey to Westminster to get their friend Sir Corbet Woodall to join the Board, he felt that, if he had never done anything else for the Company, that journey was not a lost one. It was a great many years since he himself first came on to the Board; and he thanked the proprietors now, as he had often thanked them before, for their kindness, and for the confidence placed in him. He also thanked them, on behalf of his colleagues, very sincerely for the recognition of their efforts. He desired to add that the Board most cordially joined in the thanks passed to the officers, their staffs, and the workmen. Their officers had really had most anxious times; and upon no one had the anxiety been placed more strongly than upon their Acting Manager, Mr. Moon. He had most admirably and splendidly risen to the occasion. His continuous activity carried out not only the wishes of the Board, but his own ideas and views as to the best ways in which to meet the extraordinary circumstances. The manner in which they had been met had impressed the Board very deeply. Their Secretary, too, had had a great deal of work to do in connection with these anxious times; and by him the additional work had been well done.

Mr. P. G. G. MOON, on behalf of the staff at Bournemouth, thanked the proprietors for their vote of thanks, and the Chairman for his kind words. Needless to say, without a most loyal and energetic staff, the Company could not have carried on. He was very pleased to have the opportunity of testifying to the exceptional manner in which every member of the staff at Bournemouth had co-operated with him in doing his duty in times that made very considerable demands on them all, and especially was this so of the workmen. In these times of unrest, their men had been consistently loyal. They had a very changing staff now, but they were very proud of the fact that 200 of their men had gone out to do their work for the country, and that of their staff, or rather of their staff immediately prior to the outbreak of war, no fewer than ten had taken commissions. His own predecessor—Mr. Duckham—who was closely connected with the Company, was now Assistant Deputy Director of Munitions. They took some amount of pride in this fact. And last, but by no means least, they had Major Woodall, of whom they were all very proud. The proprietors would be pleased to hear that he was now on the headquarters' staff of the First Division at Peshawur, understudying the Assistant Quartermaster-General. He (Mr. Moon) often heard from him; and his interest in the doings of the Company was keener than ever, which was saying much. They all hoped that peace would again soon bring his inspiring personality to Bournemouth. They had had their difficulties at Bournemouth, as the Chairman had told the proprietors. But he did not want to enlarge upon them. The great thing was that up to the present they had managed to overcome them.

Mr. PLUMB also acknowledged the vote on behalf of the staff and himself.

NEWCASTLE AND GATESHEAD WATER COMPANY.

The Seventy-First Annual General Meeting of this Company is being held to-day, when the Directors will submit to the shareholders the balance-sheet and accounts for the twelve months to the 1st inst.

The gross receipts amounted to £234,600; and the expenditure and working charges, including management and maintenance, to £64,651. This leaves a balance of profit of £169,949, added to which was the balance brought forward from last year, £11,340, or a total of £181,289 There has already been paid interest on the debenture stock and loans, £38,423, and interim dividends for the half year to August last, £57,248. Out of the balance of £95,671, the Directors recommend that final dividends be paid for the last half year of 5 per cent. per annum on the preference stock, £27,626; at the rate of 10 per cent. per annum on the consolidated ordinary stock, making (with that paid in August last) 8½ per cent. for the year, £19,419; and at the rate of 7 per cent. per annum on the ordinary stocks under the Acts of 1876 and 1898, making (with that paid last August) £5 19s. per cent. for the year, £22,897. There will then be a balance carried forward of £15,675.

In their report, the Board remark that the surplus shown by the accounts seems to justify a larger dividend than that recommended; but the Directors, in view of what they can only regard as an abnormal consumption, and with the uncertainties of the present time, feel they are acting prudently in carrying forward a substantial balance.

The capital expended for the year (apart from ordinary pipe extensions and meters) was only £796.

The report continues: Since the last annual meeting the Directors have had to deplore the death of their late Chairman (Sir Andrew Noble, Bart.), who was a Director for 32 years, and who enjoyed the confidence and esteem of his colleagues and the proprietors. The Directors have appointed Mr. John Meade Falkner, the Chairman of Sir W. G. Armstrong, Whitworth, and Co., to fill the vacancy thus created. Mr. John C. Hamilton, who has been a Director for 34 years and Vice-Chairman for the last 13 years, has been unanimously elected by his colleagues as Chairman of the Board.

The following are the lengths and dimensions of pipes laid during the year for extensions and military and other works :—

2 inches	3,482 lineal yards	10 inches	9 lineal yards
3 ,,	3,828 ,,	12 ,,	432 ,,
4 ,,	3,510 ,,	15 ,,	28 ,,
6 ,,	2,304 ,,		
8 ,,	21 ,,	Total	13,614 lineal yards
			= 7 miles 1294 yards

GAS-METER TESTING AT MANCHESTER.

Proposed Abolition of the Index Test.

At the Monthly Meeting of the Manchester City Council to morrow (Wednesday), a resolution will be submitted by the Gas Committee that after March 31 the testing of indices of gas-meters shall be discontinued. The resolution adds that in future the Committee will simply comply with the requirements of the Sales of Gas Act in regard to the testing and stamping of meters.

The present system of testing meters was introduced in July, 1901, as a result of a conference between the City Justices' Gas-Meter Testing Committee, the Corporation Gas Committee, and certain manufacturers of meters. The test is a "double" one—the index and drum being tested separately, and certified as correct, before the meter is issued as a completed instrument. It is declared that hundreds of pounds have been saved to the Corporation, as well as to the ratepayers of the city, by this test. The charge made by the Testing Committee has averaged 4d. per meter; and the annual cost to the Corporation has been about £400. For this they have had the assurance that every meter tested was a perfect register of the quantity of gas passing through it.

The resolution of the Gas Committee was considered at a special meeting of the Manchester Justices' Gas-Meter Testing Committee on Friday; and it was stated that an effort had been made by the Justices' Committee to arrange a conference with the Gas Committee for the purpose of discussing the resolution. The Gas Committee, however, declined the invitation, considering that no good could come of such a conference, and holding out no hope of them changing their decision upon the matter. It was also stated that a further meeting of the Gas Committee had confirmed the resolution. It was eventually decided, however, that the Gas Committee be again approached with a view to the resolution being withdrawn.

A member of the Justices' Committee confessed that he could not at all understand the attitude of the Gas Committee, but he hoped that a conference would take place between the Committees before the matter was pursued further. He pointed out that the cost of testing the meters was very small every year. It was true, he added, that very few indices were found to be incorrect; but this, he claimed, was because manufacturers had found that it was highly desirable that they should make as accurate an article as possible. Manufacturers, in fact, tested the indices before the meters were allowed to leave the works. Of the few meters that had been found to be inaccurate, however, nearly every one was in favour of the Corporation and against the consumer; and the extent to which the meters were inaccurate ranged between 20 and 120 per cent. This was a matter of great importance to the consumer as well as to the Gas Department, for surely it was not in the interests of the latter to have a dissatisfied consumer. The consumer, he added, was surely entitled to have the index tested before the meter was connected up to his fittings. The Gas Committee ought, in his opinion, to see that, as far as possible, the meters they sent out were perfect instruments of measurement.

Thirsk Gas Company.—At the annual meeting last Wednesday, dividends of 4½ per cent. on the original capital and 3½ per cent. on the additional capital, less income-tax, were declared for the half year, making 8½ and 7 per cent. respectively for the year.

TOWN GAS AND BENZOL SUPPLY.

Writing in the "Westminster Gazette" on Tuesday of last week a correspondent, signing himself "J. O.," dealt with this subject as affecting motors and motoring.

He said: When Mr. W. J. A. Butterfield read an address at Cardiff in the spring of last year, on "The Products of Coal Distillation," he dwelt upon benzol recovery, which interests us greatly now that the Government has adopted the novel expedient of stripping town gas and the gas obtained from coke-ovens for benzol, in order to extract from it the 10 to 25 per cent. of toluene, a constituent of the high explosive known as trinitrotoluene. It is, of course, regrettable in many ways that the widening scope of the war has compelled this drastic action; but, since it has been taken, it encourages one to seek all the information available in order to ascertain how this virtue of necessity will react on the petrol situation when peace comes. Mr. Butterfield has not overlooked this point; and we are indebted to him for data on the subject which are most valuable in placing the matter in its right perspective. When Mr. H. L. Doherty, of New York, in May, 1913, advocated before a meeting of experts at the Savoy Hotel the complete or partial extraction of benzol from town-gas supplies, in the belief that the extracted benzol would be of more service to the community for use as motor spirit than the benzol vapours in gas would be to gas consumers, neither he nor his audience had any notion that, little more than two years after, the whole of the gas plants in the kingdom would be nationalized for that very purpose.

And the fact that the gas plants are nationalized in this way makes one wonder whether the recovery processes installed will be permanent or not. If they are to be retained, then benzol will go a long way to relieve a situation which has been steadily hardening, till, as the result of a protracted war, it threatens to break. At present we can only sympathize to some extent with the oil companies who find it difficult to meet the requirements of the Army and Navy and keep up their supplies to private users. But we cannot be expected to forget the experiences of the past, and the uncertainty in the matter of prices. As Mr. Butterfield puts it, the plant for the extraction of toluene now being employed in many gas-works may be utilized to test the practicability of Mr. Doherty's proposal, and with some modification of its working may continue to be of service after peace has been declared. Broadly speaking, Mr. Butterfield explains that coal gas contains about 1 per cent. by volume of vapour of benzene, toluene, &c., and that if all this is extracted there are obtained about 2·25 gallons of crude benzol per ton of coal carbonized—this being the average with different classes of coal treated at different temperatures, in various forms of retorts.

And this is the point of interest to gas consumers—that the removal of all the benzol from coal gas should effect a reduction of only about 7 per cent. in the calorific power of the gas. The debenzolized gas would give practically no light with open-flame burners, though the light from incandescent burners would be affected only to a small extent. But it has been ascertained by practical trial, the author says, that at least one-third of the benzol content of coal gas, as produced in gas-works at the present day, can be extracted from the gas without reducing its calorific power below the standard of 500 B.Th.U. per cubic foot—a figure, be it noted, which conforms to the trend of recent legislation in regard to the quality of town gas, and which gives as much light with open-flame burners as is required for the uses for which they are still retained.

Hence, in Mr. Butterfield's opinion, if there is a suitable market, as we have reason to believe there is, for the extracted benzol, it would appear to be economically politic that this one-third of benzol should be taken away before the distribution of the gas to consumers. This would give a total yield in the carbonization of 16,052,487 tons of coal (1912) by the whole of the gas-works in the United Kingdom of 12,000,000 gallons of benzol. But the possible supply from coke-ovens, if the whole of the gas produced in them were debenzolized in recovery plant, would amount, on the basis of the output of coke in the United Kingdom in 1913, to about 60,000,000 gallons. This is independent of the comparatively small quantities of benzol obtained from the distillation of coal tar, which Mr. Butterfield says goes far towards meeting the present demand for benzol for chemical manufactures in this country. The consumption in the United Kingdom prior to the outbreak of war was at the rate of 130,000,000 gallons per annum, and was rapidly increasing; and he thinks the greater part of the possible output of benzol, from the complete stripping of coke-oven gas and partial stripping of town gas, might be regarded for the time being as available for motor spirit in competition with imported petrol. From this it will be seen that we have the means (presumably in full operation now) of supplying more than half the motor spirit required, not to mention the perceptible increase due to its higher thermal value.

Matlock and District Gas Company.—One of the Directors of the Company having resigned, the remaining members of the Board have had under consideration the question of filling up the vacancy, and have come to the conclusion that "at the present time it is not necessary to take this step." The accounts for the year ended Dec. 31 show a disposable balance of £6946; and after the payment of a dividend at the rate of 7s. per share on the paid-up capital of the Company for the past six months, there will be a carry-forward of £5062.

City of Chichester Gas Company.—The half-yearly meeting of the Company will take place at Chichester to-day, when the Directors will submit a report and accounts setting forth that the balance standing to the credit of the profit and loss account, net revenue (after providing for interest on the debenture stock, temporary loans, &c.), amounts to £1704, out of which they recommend the declaration of a dividend for the half year ended Dec. 31 at the rate of 7 per cent. per annum upon the "A" capital stock and £4 18s. per cent. per annum upon the "B" and "C" capital stocks, all less income-tax. The continued increase in the cost of coal and other materials, together with the decrease in the quantity of gas sold, due to the further lighting restrictions enforced by the military authorities, compelled the Directors to make another increase of 4d. per 1000 cubic feet in the price of gas from Oct. 1 last.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Feb.* 28.

There is nothing new to report in the tar products market, and values generally remain unaltered.

In sulphate of ammonia, the demand for the home market continues. The export position is without change; everything being dependent upon the granting of further licences. The quotation is still £17 5s. per ton, net, into buyers' bags, at makers' works, for 25 per cent. quality.

Tar Products in the Provinces.

Feb. 28.

There is no alteration in the markets for tar products. Very little business is being done in pitch. Creosote is still weak, and fair quantities are offering at reasonable prices. Solvent and heavy naphthas are in great demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 16s. 9d. to 20s. 9d. Pitch, East Coast, 15s. to 16s. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. to 2s. 2d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅛d. to 2⅜d. Heavy oils, in bulk, 3⅛d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

*** Through a clerical error, the quotation in the "JOURNAL" of the 1st inst. for coal tar crude naphtha and heavy oils was given as 6¾d. to 7d. and 3⅞d. to 4⅛d. respectively. The price should have been 6½d. to 7d. and 3⅜d. to 4d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Feb.* 26.

There has been more business doing during the week, but supplies have been fairly plentiful, and there has been no alteration in values. The closing quotations are £16 17s. 6d. per ton f.o.b. Hull, £17 per ton f.o.b. Liverpool, and £17 5s. per ton f.o.b. Leith. There has been some second-hand selling in the forward position at a moderate premium on spot prices, but producers still remain aloof in the hope of a distinct recovery in values all round.

Nitrate of Soda.

This market is firmer again, and holders on spot now require 16s. 10½d. per cwt. for ordinary quality, and 17s. 6d. for refined.

Sulphate of Ammonia.

From another source, it is stated that the following are the prices for sulphate of ammonia. Outside London makes, £16 10s.; Hull, £17; Liverpool, £17 2s. 6d. to £17 5s.; Leith, £17 5s.; Middlesbrough, £17 2s. 6d. to £17 5s.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is active; but the shipments are in some measure limited by the lack of ready steamers, and by the delays that have arisen in the stormy weather. In the steam coal trade, there is a very good demand, with prices firm, especially for prompt loading; and where this is obtainable, some of the collieries will pay well for tonnage. Best Northumbrian steams are variable in quotation—from 31s. to 34s. per ton, f.o.b, according to the time of delivery. Second-class steams are from 29s. 6d. to 32s. per ton, with a strong inquiry; and for steam smalls about 15s. to 17s. per ton is quoted, according to the class. The demand for fuel from Sweden for the season seems now to be setting in for steam smalls. In the gas coal trade, the inquiry is good; but the lack of tonnage is in some cases delaying shipments. Best Durham coal is quoted 25s. to 26s. per ton f.o.b.; for second-class gas coal about 24s. per ton is the price; and "Wear Specials" are 27s. per ton f.o.b. The high freights are still a factor in the gas coal trade for abroad, accompanied as they are by delay at some of the discharging ports. For Genoa, 86s. has again been paid for freight, and Tyne to Rouen is at 33s. With the cost of the sea-carriage so high, there is only cautious commitments for forward sales; but exports have been limited so far this year, and business on the season's foreign contracts ought in the usual course to be needful soon. In coke the demand is good, and values do not seem to be much changed. Good gas coke is steady at 29s. to 29s. 6d. per ton f.o.b.

British Gas Light Company, Limited.—The Directors of this Company will, at the half-yearly general meeting to be held this week, recommend (subject to audit) a dividend at the rate of 10 per cent. per annum, with a bonus of 2s. 6d. per share, for the half year ended Dec. 31, both less income-tax, and payable in April.

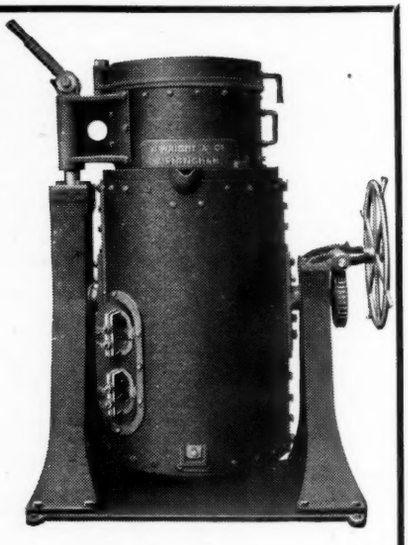
Adverse Conditions at Cleveland.—At the half-yearly meeting of the Cleveland Gas Company, last Wednesday, the Directors expressed regret that the results of the working had not been more satisfactory. The operations had been adversely affected by the high price of coal, by the lessened consumption of gas under war conditions, and by the competition of electricity. The sum of £778 had been expended on the renewal of retorts, &c., and charged to revenue; and £400 had been transferred from the contingent fund, which allowed £190 to be carried forward. The report was adopted.

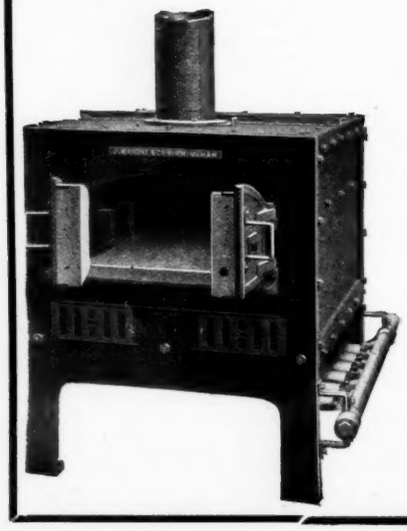
GAS FURNACES

For Heating, Annealing, Hardening, Tempering, &c.

FOR

MUNITION WORK,





MELTING

Aluminium,
Brass,
Copper,
Lead,
Stereo Metal, &c.

ENAMELLING,
LACQUERING,
JAPANNING,
POTTERY FIRING,
GLASS BLOWING, &c.

If you will send us a list of Firms in your district who should be using Gas Furnaces, we will send a Representative to interview them in our mutual interests.

JOHN WRIGHT & CO.,
ESSEX WORKS, ASTON, BIRMINGHAM.

Grays and Tilbury Gas Company.

The Chairman, Major Bartlett (T.D.), being engaged in the fighting line in command of his battery, the recent half-yearly meeting of the Company was presided over by Mr. Courtenay Fooks (the Deputy-Chairman), who pointed out that the gross revenue from sales of gas had increased from £14,603 to £16,251, and the returns from residuals from £2305 to £2530. The gross revenue for the six months was £18,787, compared with £16,928, which the Board considered highly satisfactory, having regard to the lighting restrictions. As was to be expected, the cost of production had largely increased. The net result was a profit of £5595, which was more than sufficient to pay the usual dividends. The statistics for the past year provided by the Manager (Mr. A. W. Sumner) showed that there had been a steady increase in the demand for gas; the total quantity made amounting to 153,452,000 cubic feet, which was an increase of 7·84 per cent. over the preceding year. Suitable provision was made in the accounts for dependants of employees serving in the Army. He thought the position of the Company would bear favourable comparison with that of any other gas undertaking of equal dimensions and operating under similar conditions. The dividends declared for the half year were at the rates of 8½ and £5 19s. per cent., less income-tax, on the "A" and "B" shares respectively.

Barnstaple Gas Company.—The annual meeting of the Barnstaple Gas Company was held last Saturday week, Mr. C. E. R. Chanter presiding. The report stated that the amount standing to the credit of profit and loss account was £2294; and it was proposed to declare a dividend of 5 per cent. on the "A" shares and 3½ per cent. on the "B" shares, making a total of 10 and 7 per cent. respectively for the year. The Chairman said the income for the year had been £10,905, compared with £10,814 in 1914; and the expenditure £9205 and £8158 respectively. The enormous increase in freights continued to be nothing short of a scandal. The price of gas had to be increased; but the receipts from the sale of gas yielded very little more than in 1914. The report was adopted.

East Grinstead Gas and Water Company.—It was reported at the annual meeting of the Company that the receipts from sales of gas in 1915 were £8685, as compared with £8320 in 1914; from residuals £3021, against £2495; and from water £4215, against £3980. These figures showed a total increase of £1126 in receipts over those of the previous year. In consequence of the rise in the price of coal, the Directors were reluctantly compelled at the end of the June quarter to raise the price of gas 4d. per 1000 cubic feet. The accounts showed an available balance of £8936, from which the Directors recommended dividends of 9 per cent. on the "A" stock and "A" shares, and £6 6s. per cent. on the "B" and "C" shares (less income-tax). Interim dividends of 3½ and 2½ per cent. were paid in September last, so that 5½ and £3 16s. per cent. will be payable now. This will absorb £2735, and leave a balance of £6201 to carry forward.

Basis of Water-Rates at Woking.

As was recorded in the "JOURNAL" at the time,* the Woking Water and Gas Company have been involved in litigation with a consumer, who took proceedings before the Justices for the purpose of establishing his contention that the water-rates levied by the Company should be based upon the rateable value, instead of upon the gross estimated annual rental of his premises. The Justices gave a decision in his favour; and the Company thereupon made application for a case to be stated for the decision of the High Court. The Divisional Court unanimously reversed the finding of the Justices, and decided that the rate was payable upon the gross estimated annual rental. Stating these facts in their half-yearly report, the Directors say that this result was in accordance with opinions previously obtained by the Company from Sir R. B. Finlay, K.C., M.P., Mr. J. H. Balfour-Browne, K.C., and Mr. A. Clavell Salter, K.C., M.P.; the latter of whom most ably argued the case for the Company. An appeal was lodged against the judgment of the Divisional Court; but it has now been abandoned. As to the business of the Company during the six months ended Dec. 31, the Directors point out that, after meeting the usual charges for interest, and transferring the sum of £1000 to the contingency fund, there remains a balance at the credit of profit and loss account of £7880, out of which they recommend the payment of a dividend at the rate of 6 per cent. per annum for the past half year (less income-tax), which, together with the income-tax thereon, will absorb £5047, and leave £2833 to be carried forward. During the half year, 31 additional house and 13 meter connections were made. The service-mains have been extended about 4781 yards.

* See "JOURNAL," Vol. CXXI., p. 85; Vol. CXXXII., p. 651.

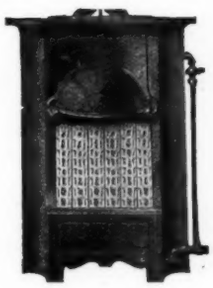
Big Increase in Consumption at Crowborough.—Presiding at the seventeenth annual meeting of the Crowborough District Gas Company, Mr. Andrew Dougall pointed out that the Board were in the gratifying position of being able to report an increase of 14½ per cent. in the sales of gas. The revenue for the year was £1849, which with the amount brought forward made a total of £4412. After deducting debenture interest, &c., and paying a dividend of 3 per cent. per annum, there is a carry-forward of £2792.

Gas Supply at Seaham Harbour.—At the annual meeting of the Seaham Gas and Lighting Company last Tuesday, dividends were declared of 8 per cent. per annum on the "A" stock and "B" shares, 6 per cent. on the "C" stock, and 4½ per cent. on the preference stock, all less income-tax. This will absorb £1070, and leave £5495 to be carried forward. The Directors reported that the make of gas during the year had been 71,898,000 cubic feet, a decrease of 2,973,000 feet when compared with 1914. A profit of £2787 was realized; and exclusive of mortgage interest and the interim dividend paid up to June 30, £6566 was available for final dividend.

The MAIN D.S.O. Fires

"DEPENDABLE."
(Reduced Type.)

"SYMMETRICAL."
(Reduced Type.)



"ORIGINAL."
(Reduced Type.)

The New Booklet contains particulars of Four different types.
Copies of the Booklet free on application.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

Gas Supply of Perth (W.A.).

Last year was a satisfactory period for the municipal gas-works at Perth (Western Australia); there having been an increase of 4¾ per cent. in the quantity of gas manufactured. Reporting upon the operations, the Manager (Mr. James Andrew) stated that the average quantity of coal gas made per ton was 12,440 cubic feet, which compares with 12,237 feet in the preceding year. The total number of meters fixed on Oct. 31 last was 3372 (of which 1392 were of the prepayment type); the increase on the year being 600, or 21·64 per cent. During the twelve months, 3680 yards of main were laid; but there was, owing to the war, great delay in the work of erecting a new holder at East Perth. Concluding his report, Mr. Andrew says that the output of gas has not increased in the same proportion as the number of connections, owing to many business places changing from gas to electric lighting, while new gas connections are for cooking purposes mainly. The additional storage space will enable the present gas generating plant to be worked to better advantage, and will permit of a somewhat increased output, but will not, until the capacity of the generating plant is enlarged, enable the service to be greatly extended. On this account, and partly because of shortage of material, stoves, meters, &c., it is unfortunately impossible to accommodate many present applicants for connections.

Rowley Regis and Blackheath Gas Company.—The annual meeting of the Company was held last Thursday, under the presidency of Mr. D. Fellows. The report stated that the balance of the profit and loss account was £937; and the Directors recommended a dividend of 6 per cent. on the "A" shares and £4 4s. per cent. on the "B" shares. The Chairman called attention to the increased sales of gas, which had been principally in the direction of supplies to manufacturers; and he further referred to the great loss of gas that had been caused through leakage, due to active mining operations in the district. The report was approved.

Guiseley Water-Works Purchase.—The Guiseley Urban District Council and the Water Company have come to an agreement, under which the latter will transfer to the Council the whole of their undertaking for the sum of £16,000 (at the rate of £2 per £1 capital), *plus* the present and any further outlay on a bore-hole which is now being made—the sum named not to include the accumulated funds of the Company. The agreement is subject to the approval of the Local Government Board; and the purchase is to be completed within a period of twelve months immediately following the termination of the war, or, if the Yeadon Water Company refuse to transfer an agreement at present existing between them and the Guiseley Company, at the expiration of such agreement. Meanwhile, the Guiseley Company will carry on their undertaking as at present. In view of this agreement, it is thought the Guiseley Council will now probably oppose the Bill which the Yeadon Water Company are promoting in the present session of Parliament to bring Guiseley into their area of supply.

Hartlepool Gas and Water Company.

The annual meeting of the Company was held last Thursday, when the report submitted showed that the revenue for the year was £83,334, and the expenditure, including interest on loans, &c., £63,478, leaving a balance of £25,856 as profit for the year. An interim dividend was paid in September last, and the Directors now recommended the payment of a dividend for the last half year at the rate of 5 per cent. per annum, less income-tax. Repairs at the works consequent on the damage from the bombardment by German warships, had been practically completed; and the cost had been refunded by the Government. The works were now fully insured against bombardment and aircraft risks. Last May the Board decided to raise the price of gas to ordinary consumers 4d. per 1000 cubic feet, to partially meet the increased cost of labour, coal, and other materials. The report added that, in anticipation of a further shortage of labour, and with the effect also of reducing the cost of gas manufacture, a contract had been entered into for the supply and erection of modern stoking machinery, with coal and coke handling plant. It was hoped to have this in operation before next winter. The Directors referred with deep regret to the death of Mr. Thomas Bower, the Consulting Engineer and late Engineer and General Manager of the Company. The Chairman (Mr. O. H. Trechmann), in moving the adoption of the report, said the war pressed on a company like theirs, as, on account of the danger from sea and air, the town had to remain practically in darkness; and this, along with the general economy which was urged upon everyone, was reducing the consumption of gas very considerably. The revenue from gas was £2830 less than during the previous year. The decrease in the sale of residuals was £1493, and in water £1003. These three sums made a decrease in the revenue of £5326. On the other hand, they had an increase in the cost of coal and oil of £3289, bringing the adverse balance to £8615. The report was adopted.

Progress at Redhill.—The Directors of the Redhill Gas Company were in the position of being able to report at the annual meeting that sales of gas in 1915 had exceeded those of the previous year by 13 per cent. Higher costs had, however, necessitated, as elsewhere, an increase in the price of gas; and this reduced the standard rate of dividend payable to 9½ per cent. on the share capital and 4¾ per cent. on the "B" stock. These dividends, less income-tax, were declared, leaving a balance of £1024 to be carried forward. A vacancy on the Board caused by death, it was decided should not be filled—a suggestion of the Directors that their remuneration should be reduced accordingly, being agreed to. The Chairman (Mr. G. R. Hunt) spoke of the loyalty of the whole of the staff and employees during the difficult times through which they were passing—entailing much unusual and strenuous work—and the patriotism shown by a considerable proportion of their regular men, who were at the present time on active service, and whose places with the Company were being kept open for them.

THE "QUICKEST" GEYSER.

SEALED SYSTEM.

Constructed of best rolled copper, tinned inside, sealed from all gas fumes.

Cleaning—disconnect two unions only to remove whole of inner chambers.

Consumption low, combined with high heating efficiency.

Manufacturers—

THE VULCAN STOVE CO.,

Limited,

EXETER.

Telegrams:
"VULCAN, EXETER."

Weardale and Consett Water Company.

Moving the adoption of the report and balance-sheet at the annual meeting of the Company on Monday of last week, Mr. A. F. Pease said the revenue during the past year had been £94,010, an increase of £531; and the working expenses had totalled £31,969, a decrease of £8553. The surplus revenue was £62,040, a total increase of £9084. Incidental expenses had advanced by 9 per cent., wages by 10·36 per cent., and rates by 28·76 per cent. Of the 160 employees, 21 had enlisted and 46 attested. They were receiving splendid support from the men left behind. For the first time for many years, there would be a slight reduction in the dividend. They worked up from a small dividend to one of 7 per cent., and now they had to recommend 6½ per cent. The report was adopted.

Corporations and Public Lighting Contracts.—Attention was called, at a meeting of the Council of the Association of Municipal Corporations, to the recently reported case of the *Leiston Gas Company v. Leiston-cum-Sizewell Urban District Council;* and the matter was referred to the Law Committee for consideration, with instructions and authority to take such steps on behalf of the Association as may be deemed advisable in the interests of boroughs which are parties to similar agreements, including (if practicable) an appeal against the decision in the case referred to. This decision was, of course, in favour of the Gas Company.

Southgate and District Gas Company.—The report of the Directors for the final six months of 1915 states that, compared with the half year ended Dec 31, 1914, there has been a reduction in the sale of gas of 3,420,400 cubic feet, or 3 per cent., and an increase of £752 in the revenue from residual products. After providing for interest charges, &c., there remains a balance of profit of £5132. The Directors recommend the declaration of dividends for the half year at the maximum rates of 5 per cent. per annum on the preference capital, of 10 per cent. per annum on the original capital, and 7 per cent. per annum on the additional capital. This appropriation will require the sum of £4325, and leave a balance of £807 to the credit of the profit and loss account to be carried forward to the current half year.

Smethwick and Female Labour.—At a meeting of the Smethwick Town Council last Tuesday, the Gas Committee reported the receipt of a letter from the Master of the Royal Mint requesting the clearance of automatic gas-meters at more frequent intervals than at present, with a view to the coins being returned into active circulation as speedily as possible. The Committee decided to give a trial to the employment of women for this work. They further reported that they had had under consideration the question of the employment of female labour at the gas-works, and they had instructed the Engineer (Mr. Vincent Hughes) to engage a number of women in connection with breeze screening or such other work as may be found useful. A mess-room for their accommodation had been provided.

Cheltenham Gas Company.

The Directors of the Cheltenham Gas Company, in their annual report, state that the balance standing to the credit of the profit and loss account enables them to recommend the payment of the maximum statutory dividend at the rate of 5 per cent. per annum (less income-tax) for the half year ended Dec. 31 upon the paid-up consolidated ordinary stock of the Company. The revenue account for the past twelve months compares favourably with that of the preceding year. In consequence of the increase in wages and the cost of coal, the Directors have, however, been obliged to raise the price of gas to the consumer; and the change now stands at 2s. 9d. per 1000 cubic feet. To provide for the further extensions of the business, the Directors in May last, with the consent of the Treasury, raised a sum of £5001, by the issue of £4990 of 5 per cent. consolidated ordinary stock, yielding a total premium of £101. From the revenue account, it appears the amount of gas sold to private consumers was 467,255,000 cubic feet, or 9,390,400 feet more than in the previous year, and that income from this source was £51,781, as compared with £46,087. The difference is partly accounted for by the fact that the price of gas, which was 2s. 1d. in 1914, was raised to 2s. 3d. in March last, and to 2s. 9d. later in the year. The total revenue from the sale of gas was £59,099, as compared with £53,291, or an increase of £5808. The amount carried to profit and loss account is £15,232, as against £13,021 the previous year.

Whitby Gas Company.—At the annual meeting of the Whitby Gas Company, Mr. Freeman Richardson, who presided, announced that the increased severity of the lighting restrictions and the paucity of summer visitors accounted for the receipts being £1152 less than in the previous year. The expenditure had, however, been reduced by £1199, and £2090 was carried forward. Dividends were declared at the rate of 3 per cent. on the original capital, and of £2 2s. per cent. on the additional and new additional capital, for the half year ended Dec. 31, 1915, making, with the interim dividends, 6 per cent. on the original capital and £4 4s. per cent. on the additional and the new additional capital for the year.

Mond Gas in South Staffordshire.—The regret of the Board that they had not been able to get a better return for the strenuous efforts made and the hard work done, was expressed by Mr. R. L. Mond, when presiding at the meeting of the South Staffordshire Mond Gas (Power and Heating) Company. He pointed out that, in addition to the rise in the price of coal, there had been great deterioration in the quality of the fuels obtainable which had adversely affected the output of gas and residuals, and also caused increased labour and expense in handling. Out of a sum available of £9926, it was decided to pay a dividend of 6 per cent. on the preference shares, and to carry forward £4976. The Board did not feel justified in recommending a dividend on the ordinary shares. The Company are now supplying 164 works, or five more than a year ago.

Science the Starting-point

¶ The design and construction of Davis Gas Appliances are, from the outset and at every stage, regulated by the unmistakable fiat of scientific ascertainment.

¶ Completely equipped laboratories and test rooms, housing the latest and most precise research apparatus, and staffed by technical experts and trained scientists, exercise a predominant influence over Davis Works activities.

¶ The value of this alliance of Science with Industry is strikingly manifest in the merit of Davis Specialities.

The Davis Gas Stove Co., Ltd. *Gas Exhibition Salons, 60, Oxford Street, London, W.*

Otley's Prosperous Gas Undertaking.

A correspondent writing to the "Yorkshire Observer" says: Even the least avaricious of Otley's ratepayers must occasionally cast covetous eyes at the profits of the Otley Gas Company. Beginning about seventy years ago with a capital of £4000, the Company have never failed to increase in prosperity; and the profits reported at the annual meeting total £4162. They are too large, in fact, for immediate disposal; the regulations only permitting, in this case, a dividend of 5½ per cent. Consequently, the carry-forward item is increased from £10,423 to £11,442. A matter for regret is the fact that the balance is partly due to an increase of 6d. per 1000 cubic feet in the cost of gas to the consumer; the price having been raised last June from 2s. 8d. to 3s. 2d. It is now eleven years since Otley seriously considered the question of purchasing, and decided, first by a ratepayers' meeting and then by a poll, not to do so. The Chairman at that time of the Otley District Council (Mr. Edward Greaves) gave the purchase price as "less than £100,000;" and some of the leading opponents to the proposed purchase said they would be in favour of taking over the gas-works if they thought a profit of £800 a year could be made. What can their opinion be now, when they ponder over the fact that the yearly profits during the last five years have averaged £4000? Assuming that the District Council could manage the gas production business as well as the Company's Directors do, it would have meant 2s. in the pound less on the district rate, and probably a little more when the necessary loan had been paid off.

Westminster Public Lighting.—Alderman Tallents (the Chairman of the Finance Committee), in presenting the estimates for the current year to the Westminster City Council, remarked that it appeared that a reduction of £3600 would be effected in gas lighting during the coming year, owing to the new contract entered into. The Works Committee anticipated a reduction of £500 under the head of electric lighting; but he failed to see how this was arrived at, as electric light was dearer. The estimate for gas amounted to £9400, and for electric light to £23,000.

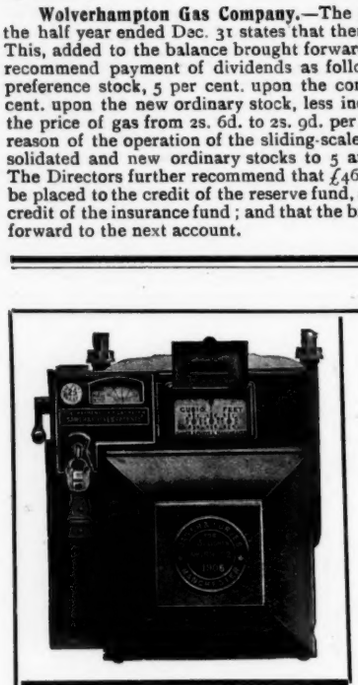
Wolverhampton Gas Company.—The report of the Directors for the half year ended Dec. 31 states that there is a net profit of £9215. This, added to the balance brought forward, enables the Directors to recommend payment of dividends as follows: 3 per cent. upon the preference stock, 5 per cent. upon the consolidated stock, and 3 per cent. upon the new ordinary stock, less income-tax. The increase in the price of gas from 2s. 6d. to 2s. 9d. per 1000 cubic feet reduces, by reason of the operation of the sliding-scale, the dividends on the consolidated and new ordinary stocks to 5 and 3 per cent. respectively. The Directors further recommend that £464, interest for the half year, be placed to the credit of the reserve fund, and £59, like interest, to the credit of the insurance fund; and that the balance of £31,725 be carried forward to the next account.

Bishop's Stortford, Harlow, and Epping Gas and Electricity Company.

At the tenth half-yearly meeting of the Company last Wednesday, accounts were submitted for the six months ended Dec. 31. The Directors reported that, compared with the corresponding period of the previous year, the sale of gas had increased by 886,100 cubic feet, or 1·3 per cent., and the income derived from residual products by £337. The balance to the credit of the revenue account for the half year was £3782. After charging £519 for interest, income-tax, &c., an amount of £3263 was added to the profit and loss account, which, with £33 brought forward from the previous half year, made the balance available for the payment of dividends £3296. The Directors accordingly recommended the declaration of dividends for the six months ended Dec. 31 at the statutory rates. The payment of these will require the sum of £3249; and leave a balance of £47 to the credit of the profit and loss account to be carried forward. During the half year there was a continued advance in the extraordinary war prices of coal and other materials required for carrying on the Company's undertaking. The drastic curtailment of the public lighting, and the complete cessation of outside and shop lighting imposed by the military and police authorities, also seriously affected the Company's business. If these unfavourable conditions continue without amelioration, a further increase in the price of gas will become inevitable. In connection with the electricity undertaking, a canvass of the householders and tradesmen in the compulsory area had been made; but, as a result of the general feeling of uncertainty due to the war, only seven or eight applications for a supply of electricity were received. The Directors therefore decided to postpone the supply of current until financial and general conditions become more favourable.

Electric-Lighting Contract and the Restrictions.—The public electric lamps at Barton-on-Humber have not, owing to the lighting restrictions, been in use for a long time; and when the Electric Supply Company sent in a bill for £140 for a half-year's lighting the Urban District Council offered to pay 50 per cent. of the amount. The Company refused this, and demanded 90 per cent., threatening proceedings. At a special meeting of the Council last Thursday night, it was decided to appeal to the Local Government Board for advice, and to ask that legislation be introduced to deal with such cases.

Bangor (Co. Down) Gas Extension.—In connection with the application of the Bangor Urban Council for a Provisional Order to acquire lands for the manufacture and storage of gas and gas-manufacturing materials in extension of the present works, a suggestion by the Local Government Board's Chief Engineering Inspector (Mr. P. C. Cowan) was adopted, and an arrangement made for taking over, under an agreement, property belonging to Messrs. R. Neill and Sons and Mr. James Fletcher. The Inspector has intimated that he will recommend the granting of the Order for gas making and storage.



The "Positive"

"THE METER OF MANY MERITS."

SAWER & PURVES, BRANCH OF METERS LTD.

MILES PLATTING, MANCHESTER.

RADFORD ROAD, NOTTINGHAM.

Agent for Scotland: JNO. D. GIBSON, 2, CAUSEYSIDE STREET, PAISLEY.

A Steadily Growing Demand at Chester.

The Directors of the Chester United Gas Company were able to report at last week's meeting that the receipts from gas for the half year ended Dec. 31 were considerably larger, owing to the increased price, and also to the greater quantity supplied; there having been a steadily growing demand throughout the year for gas for domestic and industrial appliances. Difficulties had naturally arisen, owing to the continued absence of a valuable contingent of the Company's regular employees; but those who remained had in nearly all instances loyally assisted in overcoming obstacles and in maintaining a satisfactory supply of gas. The condition of the works and mains had been well maintained; but the Directors regretted they had felt compelled to abandon for the present the provision of additional storage accommodation referred to in their report twelve months ago. The balance to the credit of the profit and loss account, after providing for payment of interest on the debenture stock and dividend on the preference stock, was £3990; and the Directors recommended the payment of a dividend on the ordinary stock in respect of the half year ended Dec. 31 at the rate of 2½ per cent., which, with the interim dividend, would make up the maximum rate of 5 per cent. for the year. The Mayor (Alderman J. M. Frost), who is Chairman of the Company, pointed out that the profit of the past half year was sufficient to pay interest charges and the usual dividends. They might congratulate themselves on this result; and he wished to express, on behalf of the Board, their appreciation of the fidelity and constancy with which the diminished staff and the regular employees of the Company, more particularly those of long service, had uniformly carried out their duties, often under the most difficult and disheartening circumstances.

Brighton and Hove General Gas Company.—At the meeting of the Company next Friday, the Directors will report that, compared with the half year ended Dec. 31, 1914, the sale of gas in the last six months has increased by 17,871,000 cubic feet, or 2·49 per cent., and the revenue from residual products by £4749. The profits, including £31 received for interest, amount to £30,935, to which is added £36,614 brought forward from the previous half year, giving a total of £67,549. After charging interest, income-tax, &c., a sum of £63,905 is available; and the Directors recommend the declaration of dividends for the six months at the statutory rates of 6 per cent. per annum on the "B" preference consolidated stock, 4 per cent. per annum on the "C" preference stock, 10¾ per cent. per annum on the original ordinary consolidated stock, and 7¾ per cent. per annum on the "A" ordinary consolidated stock. This appropriation requires the sum of £22,705, and leaves a balance of £41,200 to be carried to the credit of the profit and loss account for the current half year. Mr. Joseph Cash, M.Inst.C.E., having retired from the office of Engineer and General Manager, has been elected a member of the Board. The Directors hope in this new capacity Mr. Cash's valued services to the Company may be continued for many years.

Construction Work at Longwood.

In their report to the stockholders for the year 1915, presented at the meeting last Thursday, the Directors of the Longwood and Slaithwaite Gas Company stated that, in consequence of the high cost of production, the Directors advanced the price of gas from March 31 by 3d. per 1000 cubic feet. It was subsequently realized that the advance was totally inadequate to meet the increased cost of coal and other materials and labour; and a further advance of 3d. was consequently made on Sept. 30. These advances still fell short of meeting the extraordinary expenditure caused by the prevailing conditions. Under the operations of the sliding-scale, the higher price of gas reduced the amount of dividend divisible by 2s. 6d. for each penny advanced. As foreshadowed in the last annual report, the Directors had placed contracts for new manufacturing plant on the vertical retort system. Though the contracts were placed in February, labour and other difficulties had interfered with the progress of the work. It was stipulated that the works should be ready by Dec. 1; but they are still far from complete. Everything possible was being done to expedite them. A new 6-inch main had been laid to the Slaithwaite works, for the purpose of conveying gas at high pressure to Slaithwaite when the new works were ready. The amount expended on capital account during the year was £11,867. The quantity of gas sold was 192,028,600 cubic feet, an increase of 14,743,500 cubic feet upon the combined output of the two amalgamated companies in 1914, or 8·31 per cent. A dividend at the standard rate of £2 11s. 3d. per cent. on the consolidated ordinary stock (Longwood) and at the rate of £2 6s. 3d. per cent. on the consolidated ordinary stock (Slaithwaite) was recommended for the December half year; being at the statutory rate. Dividends for the June half were paid at the rates of 2½ and 2¼ per cent. respectively.

A Good Increase at Weston-super-Mare.—Sales of gas at Weston-super-Mare during 1915 showed an increase over the previous year of 17,790,700 cubic feet, or 7·75 per cent., which the Directors naturally consider to be extremely satisfactory. At the half-yearly meeting of the stockholders last Friday, they recommended the payment of the maximum dividend of 5 per cent. on the ordinary stock (less income-tax) for the six months ended Dec. 31.

Increased Sales at Bath.—There was an increase of more than 50 million cubic feet in the quantity of gas sold at Bath during the past year, notwithstanding a reduction in the supply for public lighting. In their annual report, the Directors stated that the great increase in the cost of coal under contracts made in the summer of 1915 rendered it necessary to raise the price of gas 2d. per 1000 cubic feet from the Midsummer quarter, to 2s. The depressed condition of the residual market referred to in the last report had changed to one of activity; and in the returns under this head some marked improvements appeared. An interim maximum dividend of 5 per cent. per annum, less income-tax, was paid for the half year to June 30, and the Directors recommended a similar dividend for the half year ended Dec. 31.

BRADDOCK'S PATENT "SLOT" METERS.

No. 261. Dry "Slot" Meter.

THE BEST SLOTS MADE.

No. 265. Wet "Slot" Meter.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), **Globe Meter Works, OLDHAM.**

Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 815.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

Telegrams: "METRIQUE, LAMB LONDON" Telephone No. 2412 HOP.

Increase in the Price of Gas Cookers in Germany.—The combine of German Gas-Cooker Makers, at their general meeting on Jan. 20, decided to advance by 30 per cent. the price of gas-cookers, in place of the earlier advance of 25 per cent. The decision was to take effect at once, and was in consequence of the further exceptional increase in manufacturing costs.

Stamford Gas Company.—At the annual meeting of the Company the report showed that the profits admitted of a dividend of 8 per cent. upon the ordinary stock, which was declared. The dividend last year was ½ per cent. more; but, in accordance with the Company's Act, it is reduced, as the extra price of coal has compelled an increase in the rate charged by 3d. per 1000 cubic feet.

Price of Gas at Halifax.—After discussion, the Halifax Town Council have adopted the Gas Committee's recommendation of an alteration in the price of gas. The price is to be 2s. 6d. per 1000 cubic feet for lighting through ordinary meters, subject to the usual 5 per cent. discount. Prepayment meter consumers are to have returned to them 1d. for each 1s. paid into the meter (instead of 2d. as hitherto). For motive power, cooking, and heating stoves through separate meters, 2s. 3d. will be charged, subject to 5 per cent. discount. These changes come into force from March 31.

Falkirk Gas-Workers' Wages.—Mr. A. O. M. MacKenzie, Sherift of Inverness, has now given his award as Arbitrator in a dispute between the Town Council of Falkirk and the employees in the retort-house at the gas-works, Falkirk. The men made an application for an increase of wages at the rate of 6d. per shift. The Council, however, argued that the men were as well paid as those engaged on similar work in other towns, and drew a distinction between hand-stoking and stoking by machinery, which is the method employed at Falkirk. The Sheriff has decided that the wages shall be raised by 3d. per shift—the advance to come into operation as from the beginning of the first full pay week from Dec. 15 last. It is to be regarded as war wages and recognized as due to, and dependent on, existing abnormal conditions.

Good Working at Tunbridge Wells.—When addressing the proprietors at the annual meeting of the Tunbridge Wells Gas Company, the Chairman (Alderman W. H. Delves) was in a position to inform them that there had been a higher production of gas per ton of coal carbonized. There had also been an increase of 19 million cubic feet in the quantity of gas sold; but this had practically all been in the first half of the year. Later, the lighting restrictions and the mild weather had affected them. He paid a handsome tribute to the work of Mr. C. F. Catt (the Secretary) and Mr. Andrew Dougall, M.Inst.C.E. (the Engineer and General Manager), who had greatly assisted the Directors during the anxious year just passed; and he expressed sympathy with the relatives of those employees who had lost their lives while fighting for the country. The report (which was adopted) stated that the profit and loss account, after paying an interim dividend and all fixed charges, showed a balance, including the amount brought forward, of £18,672, out of which the Directors recommended a dividend for the half year at the rates of 13 per cent. per annum on the consolidated ordinary stock, 10½ per cent. on the consolidated "B" stock, and 10 per cent. on the consolidated "C" and "D" stocks—leaving £13,197 to be carried forward. The great increase in the price of coal under war conditions had imposed a heavy burden upon the working; but the return to better figures for residuals had helped to relieve the strain. The Directors regretted that they were obliged to increase the price of gas 2d. per 1000 cubic feet as from Christmas last, making the price within the borough 2s. 8d.

Farnworth and Kearsley Gas Company.—At the half-yearly meeting of the Company, the Chairman (Mr. H. A. Barnes, M.A., J.P.), said the result of the six months financially speaking was identical with that of a year ago, when the balance carried forward to the profit and loss account was £2283. This time it was £2213, which implied a fairly accurate forecast on the part of the Directors, when they decided by what amount they should raise the price of gas. Everything they had bought had gone up in price; but fortunately the things they sold had advanced, which left them in the same position as before. Toluene was a substance required in high explosives; and since it could be readily extracted from the gas, the Government had applied to all fair-sized gas undertakings to extract it. They had done what they could in this matter; and though they were not paid for it, no one grudged any expense incurred to help the men in the trenches. Twelve months ago the works were insured against air-craft risks; and this insurance had been renewed. He called attention to the excellent portrait of their late Chairman, Alderman James Fletcher, J.P., which had been presented to the Company by the Misses Fletcher. The present lighting season was almost finished; and though the demands of the Army had taken 25 per cent. of the men engaged in the cotton industry, and would soon take far more, they had not yet suffered through lack of gas consumption. Personally, he was convinced there were bad times, commercially, before them; but it was certain their financial position, as a Company, was strong enough to stand a longer period of trade depression than he trusted might fall upon them. The report was adopted, and the maximum dividends of 10 and 7 per cent. were declared.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "JOURNAL" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price-Changing System is the Simplest, Quickest, and most Accurate yet devised.

ALL PARTS INTERCHANGEABLE.

Tens of Thousands in use, and adopted exclusively by many Gas Companies.

WILLEY & CO., LTD.,
Exeter, London, Manchester, Leicester.

Telegrams:
"WILLEY, EXETER."
"GASVILLADO, KINLAND, LONDON."
"METERS, LEICESTER."
"WILMETER, MANCHESTER."

Telephone Nos.:
182 EXETER.
224 DALSTON, LONDON.
4777 LEICESTER.
7419 CITY (MANCHESTER).

LONDON WORKS & OFFICES:
91-95, Hertford Road, Kingsland, N.
LEICESTER:
5, Oxendon Street.
MANCHESTER:
50, John Street, Chorlton-on-Medlock.
AGENTS FOR SCOTLAND:
D. M. NELSON & CO., 53, WATERLOO STREET, GLASGOW.

The Halifax Corporation Gas Committee have appointed four women meter inspectors, at wages for the first six months of £1 1s. 1½d. per week of 39 hours, and after six months at £1 2s. 9d. per week. Only three women were advertised for; but there were 212 applications.

On Tuesday, the 14th prox., Messrs. A. & W. Richards will, by order of the Directors, offer for sale by auction, at the Mart, Tokenhouse Yard, E.C., such an amount of 4 per cent. consolidated preference stock in the Aldershot District Gas, Water, and Lighting Company as will realize a net sum of £10,401. The capital is required for further extensions; and the issue is sanctioned by the Treasury.

At last Thursday's meeting of the Westminster City Council, the Contracts Committee reported that they had considered tenders for the supply of coke for three, six, and twelve months. As several of the tenderers had, both on the present and on previous occasions, made their prices conditional upon the rise or fall of the gas companies' prices, the Committee thought it advisable to obtain supplies direct from the companies. The Gas Light and Coke Company offered to supply coke at current market rates, allowing the Council the rate of discount usually given to wholesale buyers—namely, 1s. 8d. per ton; and this offer the Council unanimously resolved to accept.

STOCK MARKET REPORT.

BUSINESS on the Stock Exchange last week was to a great extent of similar character to that of the week before. Generally speaking, it was decidedly quiet, and, without being exactly dull, there was rather an air of languor about it which arose perhaps from a disposition to "wait and see." Government issues were thus affected. In the early days of the week there was considerable buying of the War Loan, prompted by forecastings of an early issue of a new loan at a higher rate of interest, into which the existing loan would be convertible. But the forecast fizzled out, and so the War Loan fell back into its old position. Home Rails continued lacking in animation, with small variations either way. Americans were dull and inactive, in regard to which it must be borne in mind that the Government Dollar Mobilization Scheme has practically shorn the market of much of its business. Canadians could not wholly emancipate themselves from association with the market, despite fine traffics and prospects. In the Foreign Market, a noteworthy feature was the firmness of the French loan—a testimony to the calm confidence with which the country is meeting the desperate thrust of the Germans at Verdun. Japanese was also in demand, aided by the improved returns of foreign trade; and Russian was well regarded by the light of progressive successes in the Caucasus and Persia. *Per contra*, German Imperial 3 per cents fell to 42¼, equivalent to a 7 1/16 per cent. price for money—not encouraging for their next war loan. South Africans were weak. In the Miscellaneous group, some of the old favourites were not so uniformly buoyant, and oils, copper, and rubber were mostly on the down-grade, though the last-mentioned steadied before the close. Topics of interest during the week have not been abundant, and were mainly associated with the machinations of the enemy to bolster up his decadent credit. Intrigues in regard to Argentine gold and Scandinavian liabilities aroused much discussion. Business in the Gas Market was more active, and the prices recorded indicate general firmness. It should be noted that several issues are now being quoted *ex div.*, and allowance should be made for the amounts thus deducted. In the Money Market, rates were steady generally.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 75, 75¾, South Metropolitan 75, 75¼, 75⅝, 76. On Tuesday, Gas Light ordinary 74⅞, 75, ditto debenture 60¾, Imperial Continental 64¼, 64⅜, South Metropolitan 75⅛, 75¾, ditto debenture 60½. On Wednesday, Brentford "B" 84⅜, Gas Light ordinary 74⅜, 75, ditto preference 74, 74⅛, ditto debenture 60¾, Primitiva 2⅛, South Metropolitan 75, 75⅜. On Thursday, Brentford "B" 85, Commercial debenture 57, Gas Light ordinary 74, 74⅛, 75, ditto maximum 60½, ditto preference 74, 74⅛, 75, Imperial Continental 64¼, 64⅜, Newcastle 78, Primitiva 2 1/16, ditto preference 3 1/16, South Metropolitan 75, 75⅛, 75⅜. On Friday, Commercial 4 per cent. 72, ditto debenture 56¾, Cape Town 1⅜, European 12⅜, 12 7/16, Gas Light ordinary 73⅛, 74, 74⅛, ditto preference 74⅜, ditto debenture 60½, 60⅝, 61, Monte Video 8, 8¼, San Paulo preference 8 1/16, South Metropolitan debenture 60⅛, 60⅝, 60⅜. On Saturday, Commercial 4 per cent. 72⅛, Gas Light ordinary 73⅛, ditto debenture 61, 61⅛, 61¼, Imperial Continental 63⅛, 63⅜, Monte Video 8⅛, Primitiva 2, 2⅛, South Metropolitan debenture 60 1/16, 60⅛.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div. or Interim and Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	..
374,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	£5	April 29	7⅛	3/-	Bombay, Ltd.	5⅛—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water: 10 p.c.	29—30	5 6 8	..
333,110	10	,,	7	7/-	Bournemouth Gas and Water: B 7 p.c.	15—15½	4 10 4	..
115,000	10	,,	6	6/-	Bournemouth Gas and Water: Pref. 6 p.c.	13½—14	4 5 9	..
159,740	—	—	—	4	Bournemouth Gas and Water: 4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	£6/-	Brentford Consolidated	261—266	5 5 8	..
734,920	,,	,,	†11	55/-	Do. New	204—209	5 5 8	81½—85*
55,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
221,400	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10⅜	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	7⅜	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	1⅜
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
167,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	72—72½*
560,000	,,	,,	5⅛	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	56⅞—57
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	5½	Derby Con. Stk.	128—135	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17⅛—18	5 11 1	12 7/16—12 7/16
16,857,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke: 4 p.c. Ord.	98—102	4 15 6	70⅜—75½*
2,600,000	,,	,,	3½	3½	Gas Light and Coke: 3½ p.c. max.	76—79	4 8 7	60⅛*
4,062,235	,,	,,	4	4	Gas Light and Coke: 4 p.c. Con. Pref.	96—99	4 0 10	74—75*
4,674,850	,,	June 11	3	3	Gas Light and Coke: 3 p.c. Con. Deb.	72½—74½	4 0 6	60⅛—61½
130,000	,,	,,	10	10	Gas Light and Coke: 10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
181,000	Stk.	Mar. 12	7⅛	7½	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜	5⅞	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	63⅛—64¼
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
300,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
2,498,905	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A / B	211—213 / 146—148	4 13 11 / 4 14 7	..
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	£5	June 11	6	2/-	Malta & Mediterranean	4⅛—4⅜	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne: 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	8—8⅜
1,875,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	78*
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅜	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7⅛—7⅜	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5⅛—6	6 13 4	2—2⅛
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4⅝—5	5 0 0	3 1/16
521,500	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo: 6 p.c. Pref.	10½—11	5 9 1	8⅛
125,000	50	July 1	5	5	San Paulo: 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 8	..
309,984	,,	,,	10	10	Do. B	223—224	4 9 8	..
638,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	75—76*
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60⅛—60⅞
324,830	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7⅛	7⅛	Tottenham District: A 6 p.c.	135—138	5 8 8	..
782,275	,,	,,	6	6	Tottenham District: B 5½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	4	Tottenham District: 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	6	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
80,000	Stk.	Feb. 26	8⅛	78/9	Wandsworth, Wimbledon, and Epsom—Wandsworth A 5 p.c.	151—156	5 7 4	..
255,696	,,	,,	6⅜	63/9	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6⅛	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅜	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

* Ex. Div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointment Vacant.

ANALYST. Powell Duffryn Company, Aberdare.

Sale of Stock.

ALDERSHOT GAS, &C., COMPANY. London Mart. March 14.

TENDERS FOR

Coal.

ABERTILLERY URBAN DISTRICT COUNCIL. Tenders by March 9.

DARWEN GAS DEPARTMENT. Tenders by March 4.

General Stores (Ironmongery, Oils, Paints, Steel Goods, Castings, Pitch, &c.).

BRIGHOUSE CORPORATION. Tenders by March 15.

Fire-Clay Goods.

BRIGHOUSE CORPORATION. Tenders by March 15.

Meters.

BRIGHOUSE CORPORATION. Tenders by March 15.

Pipes.

BRIGHOUSE CORPORATION. Tenders by March 15.

PLYMOUTH CORPORATION. Tenders by March 23.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 23s. 6d.; Half Year, 12s.; Quarter, 6s. 6d.
Payable in advance. If credit is taken, an extra charge of 4s. a year is made.

Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 171, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

ALDER AND MACKAY
ESTABLISHED 1850).

WET AND DRY METERS.
SLOT AND ORDINARY.
STREET LAMPS AND AUTOMATIC CONTROLLERS.

EDINBURGH.

MEWBURN, ELLIS, AND PRYOR.
CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70, Chancery Lane, London.
Telegrams: "Patent London." 'Phone: 243 Holborn.
And 3, St. Nicholas Buildings, Newcastle-on Tyne.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS.
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2396 HOLBORN.

SULPHURIC ACID.

SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.,
36, Mark Lane, LONDON, E.C. Works—SILVERTOWN.
Telegrams—"HYDROCHLORIC, FEN. LONDON."
Telephone—1588 AVENUE (3 lines).

TAR WANTED.
JOSEPH A. HUTCHINSON, LIMITED,
HIGHBRIDGE WHARF, SOMERSET.

FOR
DRY METERS
TRY
JAMES MILNE AND SON, LIMITED.

R. & G. HISLOP,
GAS ENGINEERS, RETORT BUILDERS, CONTRACTORS, &c.

RETORT SETTINGS, COAL TESTING PLANT, BOILER FIRING.

Communications should be addressed to UNDERWOOD HOUSE, PAISLEY.

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Feb. 22, p. 440.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, London, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"BRADDOCK, OLDHAM," and "METRIQUE, LAMB LONDON."

SEND your inquiries for Carburetted HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—
BALE AND HARDY,
39, VICTORIA STREET, WESTMINSTER, S.W.

FOR
PREPAYMENT METERS
TRY
JAMES MILNE AND SON, LIMITED.

TAR WANTED.
THE Burnden Tar Company (Bolton), Ld.
HULTON CHEMICAL WORKS, BOLTON.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams—"SATURATORS BOLTON." Telephone 0648.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the Enrichment of Gas.
Manufactured and Supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agents, F. J. NICOL & Co., Pilgrim House, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

J. E. C. LORD, Ship Canal Tar-Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

CHELTENHAM GASLIGHT AND COKE COMPANY.

OUTDOOR SUPERINTENDENT.

THANKS are expressed to Candidates who sent in APPLICATIONS for the above.
J. PATERSON,
Engineer and General Manager.
Gas-Works, Cheltenham.

WANTED—an Analyst to do Work in Connection with Coke-Ovens and Bye-Products.
Apply, stating Age, Experience, and Salary required, to the POWELL DUFFRYN COMPANY, Aberaman Offices, ABERDARE.

GASHOLDER For Sale—230,000 feet capacity. Very strong, nearly new, giving 10-inch Pressure, 80 and 78 feet diameter, 24 feet deep each Lift; 10 Lattice Standards; Two Rows Lattice Girders. New STEEL TANK if required. Ready for Removal.
FIRTH BLAKELEY, SONS, AND CO., LTD., Gas Engineers, CHURCH FENTON, LEEDS.

OXIDE OF IRON.
We are in a position to Supply Oxide of Iron promptly, and invite Enquiries.
SPENT OXIDE WANTED.
BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.

"TORTO" FIRE CEMENT.
BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.

"KLEENOFF," THE COOKER CLEANSER.
Tins for sale to Consumers.
In Bulk for Works Use.
BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.

FOR
ALL METERS
TRY
JAMES MILNE AND SON, LIMITED.

WANTED—Good, Clean, and Hard CARBON, in Four-Ton Lots, or more, f.o.r.
Address, No. 6072, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

BOROUGH OF BRIGHOUSE.

TENDERS FOR STORES.

THE Corporation invite Tenders for the Supply of the following Requirements during the Twelve Months ending March 31, 1917.

SECTION A.—GAS DEPARTMENT.

1.—GAS-METERS, Drys, Slots, and Ordinarys.
2.—IRONMONGERY, including Lead Pipe, Cotton Waste, Iron, and Steel.
3.—WROUGHT-IRON TUBES and FITTINGS (including Malleable Fittings).
4.—OILS, PAINTS, &c.

SECTION B.—HIGHWAYS DEPARTMENT.

CURBS, FLAGS, FIRE-CLAY GOODS, PITCH, OIL, BRUSHES, STEEL GOODS, IRON CASTINGS, and SAND.

Form of Tender for each Item, together with Specification and Particulars, may be obtained from Mr. Harold Davies, Engineer and Manager, Gas-Works, Brighouse, for Section A, and from Mr. S. S. Haywood, Borough Engineer, Municipal Offices, Brighouse, for Section B.

Sealed Tenders, duly endorsed, must be sent to the undersigned not later than Wednesday, the 15th day of March, 1916.

The lowest or any Tender not necessarily accepted.

JAS. H. ROTHWELL,
Town Clerk.

Municipal Offices,
Brighouse, February, 1916.

ABERTILLERY URBAN DISTRICT COUNCIL.
(GAS AND ELECTRICITY DEPARTMENTS.)

TENDERS are invited for the Supply of the whole or part of the Requirements of COAL of the above Departments during the Period of Twelve Months ending March 31, 1917.

Further Particulars may be obtained from the undersigned, to whom Tenders should be Delivered not later than March 9, 1916.

E. D. WOOTTEN,
Engineer and Manager.
Gas-Works, Abertillery, Mon.

BOROUGH OF DARWEN.

TENDERS FOR ROUGH GAS SLACK AND NUTS.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the Supply of Rough GAS SLACK and NUTS for One Year, to be Delivered at the Gas-Works Sidings in Corporation Waggons.

Forms of Tender and all Information as to quantities may be obtained on Application to Mr. A. H. Smith, Gas Engineer, Darwen.

Sealed Tenders, endorsed "Gas Coal," must be Delivered to the undersigned, not later than March 4, 1916.

No Tender necessarily accepted.

WILLIAM P. HALLIWELL,
Town Clerk.
Town Clerk's Office,
Darwen, Feb. 15, 1916.